ELECTRICAL WORLD

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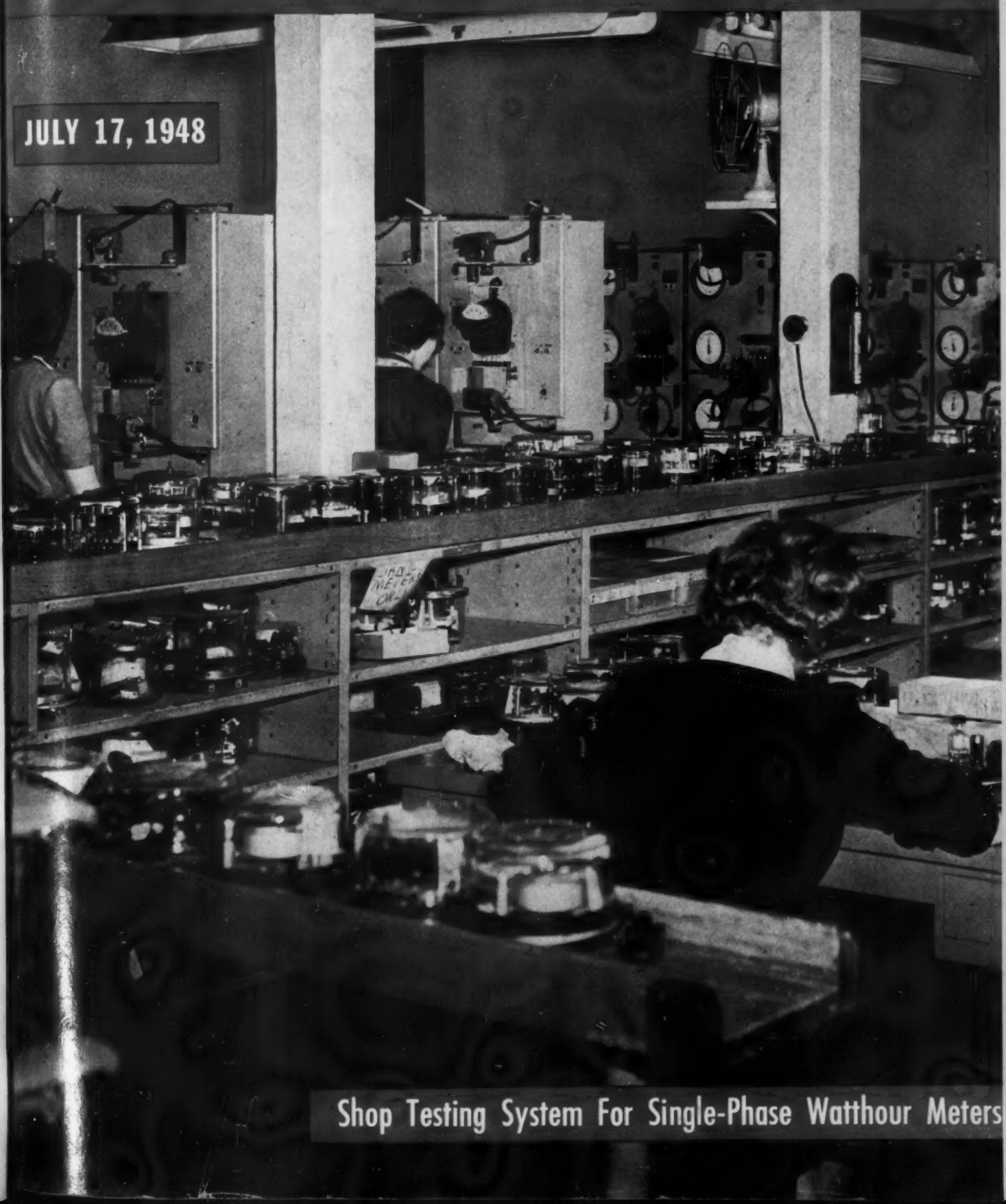
JULY 17, 1948



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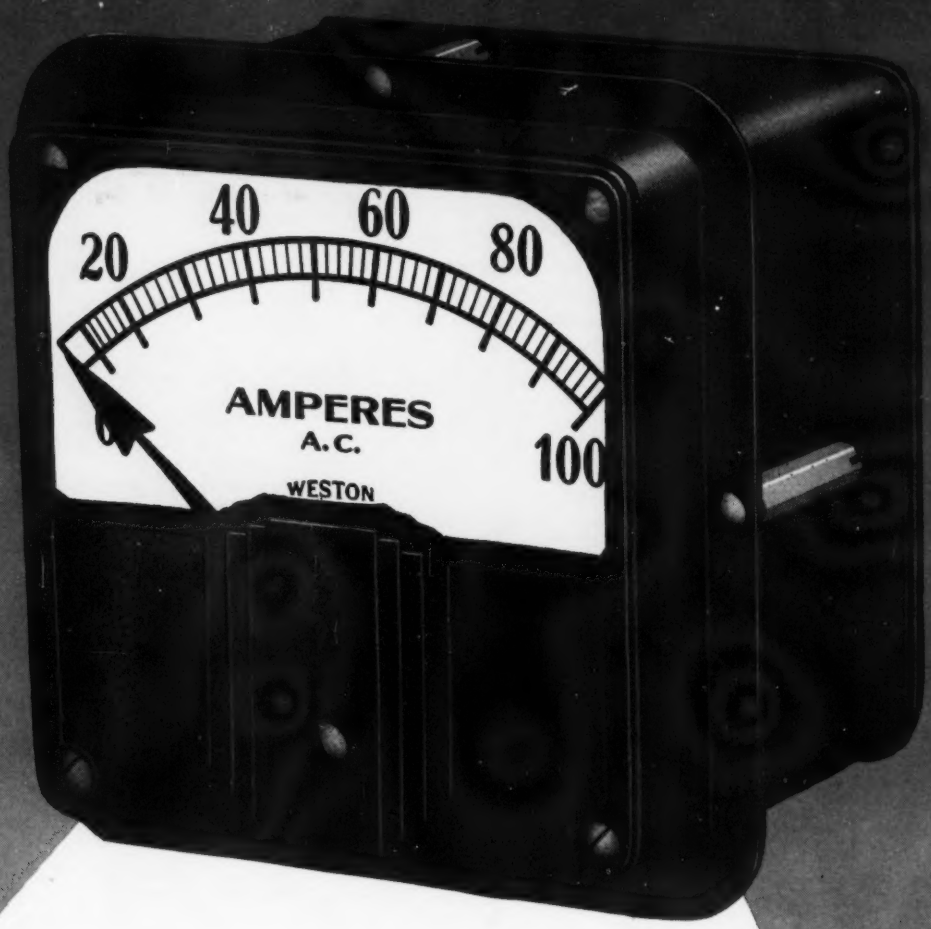

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ELECTRICAL WORLD

Published for 74 years for those engaged in the business of generating, transmitting, distributing or applying electric power

July 17, 1948 Vol. ~~129 No. 29~~ 130 #3

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Utilizing an assembly line technique, Pennsylvania Power and Light Co reconditions and shop tests its single-phase watthour meters at periodic intervals. This EW staff photo shows the mass testing and maintenance methods used

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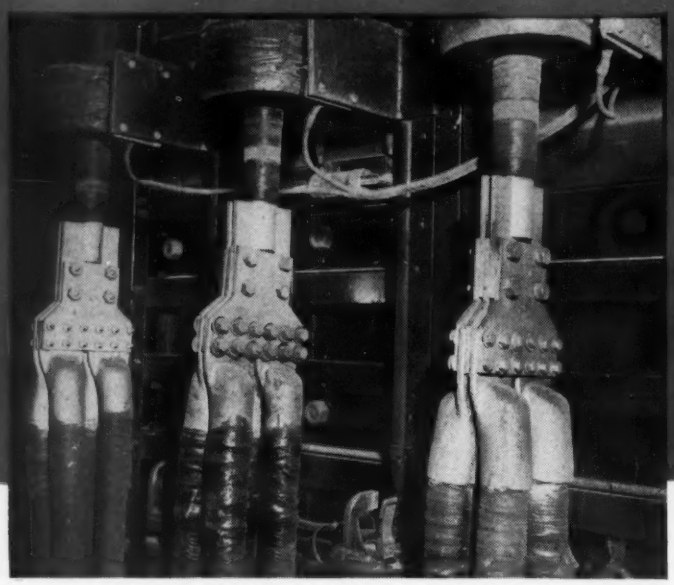
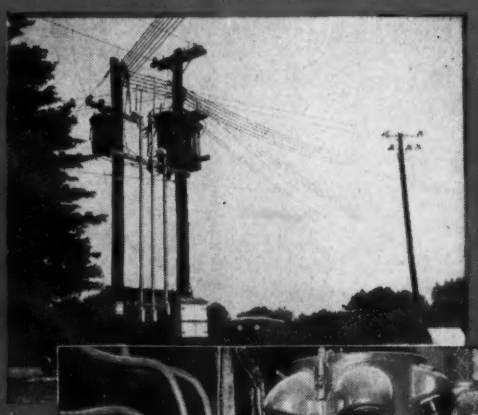
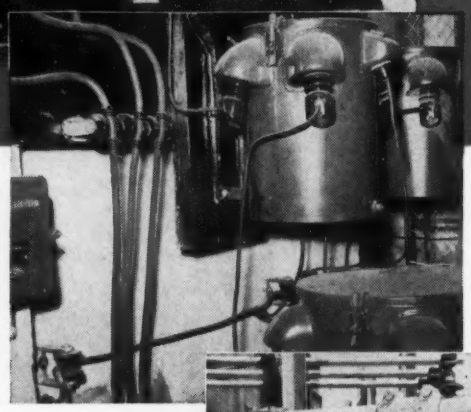
COMING IN THE JULY 31 ISSUE
Lighting Sales, The Revenue Builder

Indoors . . . Outdoors . . . Today and 30 Years Ago . . .
ALUMINUM HAS PAID OFF ON MANY INSULATED WIRE AND CABLE INSTALLATIONS



INSTALLED IN 1916 and still operating satisfactorily today. 450 Volt D.C. line carrying 1390 amperes per cable in a Rotary Converter Station. The four 1,590,000 CM aluminum cables insulated with varnished cambric involved 1700 connections to the apparatus.





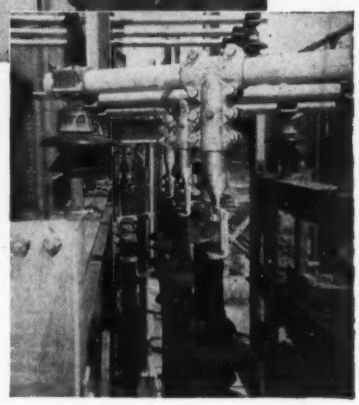


FIGURE IT IN ALUMINUM

Hazard insulated aluminum conductors are being used to advantage for many building wire installations as well as underground, aerial and service entrance cable requirements. Cost savings up to 40% . . . weight savings up to 60% . . . easier handling and pulling — results like these make it worth your while to investigate the use of aluminum conductors when figuring a job.

Hazard Performite Type RH Aluminum Building Wire is carried in factory stock and by many wholesalers — for immediate shipment in sizes 6Awg to 500,000 CM. Other sizes and cable designs can be fabricated in as little as 4 to 6 weeks. Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

(Top) **LIGHTING INSTALLATION.** Performite double braided cable with aluminum conductors used for permanent outdoor lighting wiring at a new sports arena in Pennsylvania. *(Center)* **POWER FEEDER CABLES** with aluminum conductors, Performite insulation, Hazaprene jacket, 5KV, used in a state centennial exhibition. *(Bottom)* **HIGH VOLTAGE POWER SUPPLY.** 15KV cables with 800,000 CM aluminum conductors terminated outdoors with welded aluminum lugs bolted to aluminum bus in large southern industrial plant.

Write for Bulletin H-407-AL which contains tables, calculating data and details of simple splicing and terminating methods.

6116

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insulated wires and cables for every electrical use

ELECTRICAL WORLD Editorials

JULY 17, 1948

Keeping Faith With the Customers

AT THIS TIME last year, there was an argument as to whether the United States was experiencing a power shortage. It was a pretty pointless dispute, for those who waged it refused quite resolutely to define a power shortage. Efforts were made to picture as totally black or entirely white a situation which was substantially gray.

Today, we are much less troubled with the argument. This is so because the facts have become apparent to everyone with any interest in them. It is perfectly plain, for instance, that the power industry needs capacity—all it can get. If not, the industry wouldn't be spending every nickel it can raise—plus a few million it hasn't yet raised—for new plant. And it's equally apparent that John Public can flip that switch and get electric service. Truly, the grays have it.

What is interesting today is neither the defeat of those who shrilled "blackout" for political reasons, or the confusion of those who chanted "no problem" for equally political reasons. Rather, this season's interest lies in the way some companies are laying their problems right on the line with the public. It's true, of course, that a few companies did this last year.

There is, for instance the Cleveland Electric Illuminating Co. Two weeks ago, this utility said flatly in a public statement that for five days weekly during a coming eight-month period, loads will exceed supply unless steps are taken to balance them. Then it explains the steps it proposes to take. That's a bald statement of a grave situation, of course. And it may be that few companies actually face so serious a pinch. The point, though, is that CEI "saw its duty and did it." It may be that the economics of a war and post-war inflation will grind out a situation whereunder some Cleveland workers will have to be idle for lack of power for a few days next winter, and nobody will be happy about that. But with this step, CEI has done what it can do and should do to inform and prepare those who depend upon it. It has spotted a possible source of serious trouble well in advance. It has taken those steps within its power. These being insufficient, it has notified those who will be effected and established a program to eliminate the trouble or to reduce it as much as it can be reduced. How much better off CEI will be, whatever happens, as a result of its decision to make the facts—indeed, the realities—known.

Suppose a power system were to decide otherwise than to tell its story publicly, and in all detail. Then it would have two choices. One of these, the more unthinkable, would be to let things drift, hoping it could enjoy good fortune or to improvise successfully if it didn't.

The other choice would be to prepare a plan to balance loads and capacity and peddle it to the affected customers strictly on the quiet. But how quiet can one keep something which affects the economic life of a community, something that threatens almost every paycheck in town? Certainly, one can't hide any switch of work shifts. Nor can any company, for very long, successfully attribute to anything else a drop in production which is caused by a power shortage. Facts, or even more dangerous, distortions of them, just do get around. And good public relations never did thrive on rumors, evasion and tardy denials which never catch up with the story.

MORE Power to England

BRITAIN'S ELECTRICITY AUTHORITY took a spanking recently in Commons because it had issued a poster showing a child climbing on a chair to reach an electric switch. The poster's caption: "Mummy Forgot to Turn Off the Light." The catch: the light switch already was at the "Off" position.

What happened was that the Authority's publicity budget was a little low. So, in an attempt to put over a power conservation message, it picked up a poster which had been left behind by a nationalized private utility, aimed at BOOSTING power consumption. As "Observer" pointed out in the "Financial Times," "B. E. A.'s publicity experts apparently were too bemused by their new nationalized dignity to perceive the catch about the switch."

Nobody would attempt to evaluate the effectiveness of a newly-nationalized power system on the basis of one public relations boner such as this. But the incident certainly carries a warning to everyone in the power business. Here's Britain's power system asking people to turn OFF the lights. An outfit whose job it is to make and sell electricity is asking people NOT to use its product.

Well, one might say, that's been done by a few systems in this country and may very well be done by a lot more before the next four years have passed. That's only too true. But there's a difference.

British electrical people have made it plain for months that four years from now, that nation's power capacity deficit will be almost 1,000,000 kw. Britain is planning affirmatively on a continuing power shortage. Wherever we stand now, we're certainly doing nothing of that nature. Power people in this country are working themselves thin to get a big fat reserve into place. And the heavy thinkers are indicating almost every day their belief that when today's expansion program has been achieved, the decks will only have been cleared for another, longer expansion. You bet there is a difference between England's stoic resignation to continuing shortage and our scrambling to avoid any service defection and to get a 20% reserve.

Nationalized or privately-owned, any power system which accepts as inevitable a situation where the urge is to conserve electricity, rather than use more and more of it, is a power system which isn't doing its job. It may be charged that any such bland pronouncement ignores the realities of Britain's economic position. But it can be charged in return that perhaps too great a concern is being paid these economic realities.

Why is England skimping on everything her citizens want for a better life? To get more and more production available for export. Why such emphasis on exports? To get foreign currency. Why? To be able to import what it needs to live and rebuild. To rebuild? Rebuild to what? To a world stature such as it has known. And is England going to regain its former heights in trade, in manufacturing, in standard of living by conserving electric power? Not if the United States is any example of how to grow to great stature. The path England must follow is just the opposite of power conservation. England has to learn what power is and how to use it.

If nationalized power in England is conserving energy only until new machines can be got into place, there's no worry. But if it's restricting the use of power, deliberately and over a long term, in favor of added production elsewhere, then the British are in a lot worse shape than we ever believed they were.

Sic Transit Gloria Mueller

IT TOOK a little longer to achieve than had been anticipated by some people, but it happened at last—George Mueller's removal, that is, as effective head of the electric utility workers in Pittsburgh.

Exactly what it was that brought about the downfall of this leader—who forced a major city and industrial area to endure 27 days of burdensome but ineffective disruption of power service—would be hard to say. It's probably a sage guess that Mueller is out today not because he led a nonsensical strike in a vital industry but because Congress passed the Taft-Hartley Act last year. For it was in nine elections under Taft-Hartley that Mueller saw his once-powerful Independent Union snatched away by the International Brotherhood of Electrical Workers, AFL. Of course, it may be that Mueller's reckless strike leadership led those who once followed him blindly to vote against him—to choose the IBEW, AFL, rather than the Utility Workers Union, CIO, which Mueller favored. But little success if any attended the steps to oust Mueller which preceeded the enactment of Taft-Hartley; so those in Pittsburgh who don't like power strikes may find at least one reason to approve that "slave-labor" law.

Just after the 1946 power strike, it wasn't hard to find in Pittsburgh responsible labor leadership which agreed that, had Mueller's union been affiliated with either the AFL or the CIO, it would have won the strike it lost so completely. Had it been so affiliated, Mueller's Independent probably would have commanded strong sympathy action by unions on neighboring systems. And had such sympathy action succeeded in isolating the Duquesne system, the strike almost certainly would not have been lost. It was no secret that Duquesne, in spite of its splendid supervisory workers, kept the system together on imports from neighbors. Its own generation was good —but not that good.

That's where Taft-Hartley can help again. Now that Duquesne employees are affiliated with IBEW and CIO, they still won't be able to command sympathy strike action against the interconnection, should they walk out again. For Taft-Hartley outlaws sympathy strikes and secondary boycotts.

At that, talk of another Duquesne strike seems unrealistic. By far the predominating leadership on the Duquesne system today is IBEW. Faults it may have, but such leadership as Mueller's is not one of them.

Vol. 129 No. 29

NEWS
OF THE ELECTRICAL WORLD

The Electrical Week

The Civil Aeronautics Administration proves to be the latest federal agency with regulatory jurisdiction over the electric power industry. Under a brand new law, CAA may forbid erection of structures too close to airports. And it's considering using the new authority on that new Pepco plant near Washington's National Airport . . . National Security Resources Board is undertaking a broad study of power supply for aluminum production. The emphasis seems to be on long-range aspects of the problem . . . In Paris, American delegates to CIGRE agreed that Europeans have the jump on U. S. power systems in long-distance, high-voltage a-c transmission . . . Back in Washington, Wage-Hour Administrator McComb has interpreted the "overtime-on-overtime" ruling and set Sept 15 as enforcement day . . . Federal Works Administration has eased a financial burden for the Santee-Cooper project by postponing a bond retirement for five years and letting the funds be used for new capital . . . And the atom went commercial this week. AEC is permitting commercial sale of compounds and drugs with "tracer" elements in them. AEC will sell at prices which will yield a profit and will drop a product whenever a private firm is ready to sell it commercially.

ECA wants American capital to move into Marshall Plan countries to help with the European reconstruction job. It's willing to guarantee that earnings will be convertible into dollars. The guarantee extends until 1962 and is limited to $300,000,000 during the first year. There is no guarantee of profits or against ordinary business or political risks.

Both the Bureau of Mines and the Alabama Power Co are going to try again on underground gassification of coal. Alabama Power has contributed another 300 acres of land. The Bureau has okayed a $411,000 expenditure on the new test.

Attention load builders: The people who make room coolers say demand for them is booming. In some cases, production is allocated to dealers. The outlook is for sales of at least 150,000 units in the next five years.

Portland General Electric is continuing its "work-scholarship" program begun last year to encourage greater enrollment in electrical engineering courses. Eleven sophomores and juniors at Oregon State College have ben awarded summer job scholarships and will be assigned to office, shop and operating divisions of the company.

The boom in consumer credit isn't as disheartening as the bald statistics make it sound, according to the American Bankers Association. Standing at an all-time high of almost $14,000,000,000, consumer credit today looks huge. But ABA says that figure is far below the pre-war peak in terms of national income and of the number of borrowers.

Westinghouse President Gwilym Price joins the list of those forecasting power expansion well beyond today's five-year plan. He told EEI conventioneers that in the next 10 years power facilities "...will need to grow to about 95,000,000 kw...an annual increase of over 4,000,000 kw even without replacement..."

Missouri co-ops, with loans of $28,863,842, led all co-ops in getting REA loans during the fiscal year just ended. For the fiscal year just started, they lead all co-ops in seeking new loans—$39,777,000 in applications now on file. But Missouri is second to Texas in the amount of loans granted since REA was founded. Texas has drawn $114,458,000.

Pennsylvania's Secretary of Commerce, Orus J. Matthews, told a utility group in Philadelphia recently that he keeps a curve of his own month-to-month electric bills. The curve is nice and flat and it makes him very happy. "Why don't the utilities do something to tell the man on the street what a good job they're doing?" he asks.

Electrical retailers in eastern Pennsylvania don't like a Pennsylvania Power & Light Co plan to furnish appliances to PP&L workers at 20% discount. All but two of 45 retailers who would be covered voted against it recently. The National Retail Dry Goods Association opposed the plan also.

Law Gives CAA Control over All Construction near Any Air Field

NOTE to electric utility engineer: Don't plan to build that new steam generating station too close to an airport. The Civil Aeronautics Administration may block the project.

CAA now has a law, signed by the President on July 1, which gives it broad powers, including condemnation authority, to prevent any construction near air fields which it considers a hazard to flying safety. For the past few days it has been conferring with the Justice Department on the possibility of utilizing the new law—PL 872—to force alteration of the new generating plant being built by the Braddock Light & Power Co. at Alexandria, Va.

Bone of contention over the Alexandria plant, which is being built more than a mile and half south of Washington's National Airport, is the height of the stacks. Braddock, a Potomac Electric Power Co subsidiary, currently plans to raise stacks to a height of 193 ft above mean sea level. CAA and private flying organizations say that the stacks should be no higher than 162 ft in the interest of safety of planes using National Airport.

Alexandria, which has a comprehensive anti-smoke ordinance, also is involved. Stacks as low as 162 ft would violate the ordinance, city officials say. They fear any reduction below the 193-ft level will result in more smoke and soot pouring over the city which for the most part is residential.

There the matter stood during conversations among CAA, PEPCO and Alexandria representatives (EW, May 15, Page 5). Then Congress passed an amendment to the Civil Aeronautics Act of 1938. The amendment gives the CAA administrator authority to purchase or condemn "airspace" adjacent to airports and needed to insure air safety. Acquisition could be made whenever funds are "available."

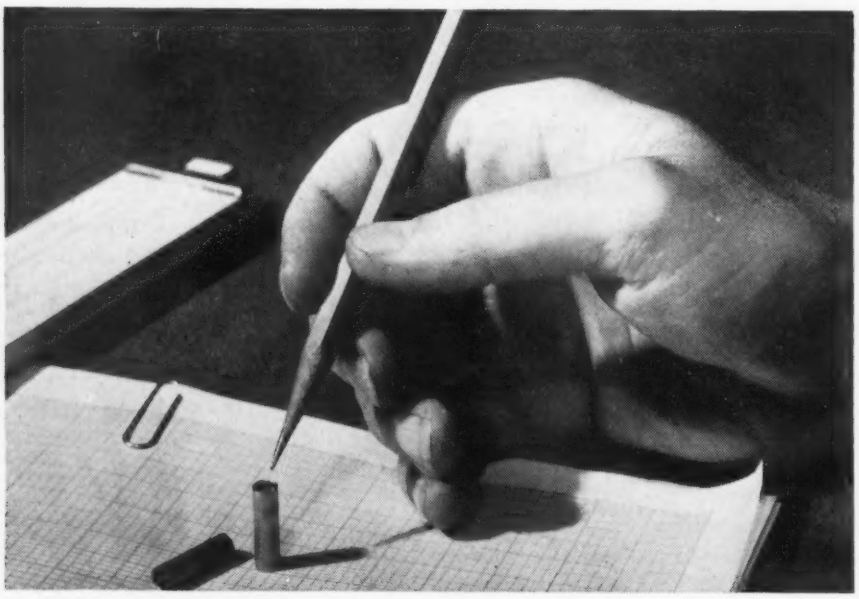
Congress made no funds available to CAA especially for such purposes, but it is conceivable that the agency might start condemnation proceedings for any property now and ask Congress for the necessary funds to complete acquisition later.

It is deemed unlikely, however, that such procedure would be followed in the case of the Alexandria plant. Negotiations between CAA and the city of Alexandria apparently are continuing. PEPCO, which twice revised its construction plans to lower the height of the stacks, adding provisions for special smoke and soot control installations, has invested more than $1,500,000 in the project already, according to independent estimates. Construction is continuing.

CAA is almost certain to deal more stiffly with similar situations arising in the future. It already has issued a regulation requiring advance notice of plans for "structures which may by reason of their height and distance from a landing area become a hazard to air navigation." Notice must be filed 30 to 60 days in advance of construction of buildings within 1,500 ft of an airport if the structure is to exceed a height of 5 ft for every 500 ft it is distant from the landing field. Further, notice must be filed of any structure exceeding 150 ft in height to be erected within 20 miles of a civil airway.

CAA is known to be eyeing with disfavor a number of structures, both completed and under construction, near airports throughout the country. A special problem, it is reported, is posed by radio broadcast stations, most of them located in suburban areas found most suitable for airport sites.

The problem has become more acute of late, it is reported, with the advent of frequency modulation broadcasting and television. Both forms of broadcasting require higher towers than formerly used for low-frequency radio. In many cases, it is reported, FM and television equipment is being mounted atop existing broadcast towers. CAA feels that the added height simply increases an existing air hazard.



IT'S THE CAT'S WHISKERS. Developed by the Bell Telephone Laboratories' technical staff, this simple device, less than an inch long, performs nearly all the functions of an ordinary vacuum tube. Known as the Transistor, its principal parts consist of two point contacts of the "cat's whisker" or detector type touching a pinhead of solid semi-conductive material soldered to a metal base. Input power delivered to one of these contacts is amplified at least 100 times (20 decibels) and transmitted to the other terminal where it is delivered to an output circuit. This device, however, will not be on the market for some time

•

Iowa Co-op Will Build 15,000-Kw. Steam Station

A $4,125,000 loan from REA has made it possible for the Southwestern Federated Power Cooperative, Inc, Creston, Iowa, to begin a two-year construction program. Two 7,500-kw steam-driven generators will be installed, seven substations will be built, and 150 miles of 34.5-kv transmission lines will be erected.

Southwestern now has under construction a generating plant which will have five 1,100-kw generators, each driven by a 1,500-hp diesel engine. The plant is to be ready in September.

The co-op also has under construction 170 miles of 34.5-kv transmission line in Adair, Cass, Adams, Ringgold, Decatur, Wayne, and Clarke Counties.

A new office building is to be ready in August. The co-op is also equipping all trucks and cars with radio. The radio system will cover all territory in a 50-mile radius from Creston.

Southwestern was formed in 1941 by five distribution co-ops with headquarters at Greenfield, Osceola, Mt. Ayr, Corning, and Stanton.

Power for Aluminum Production Under Study by NSRB Advisors

FUTURE electric power requirements for aluminum production and means of meeting them are being thoroughly scouted by a special "task committee" of National Security Resources Board advisors. The 12-man group will make preliminary reports by July 28, then meet with aluminum industry and Munitions Board reresentatives in Washington a month later.

Studies of the group probably will be aimed chiefly at developing long-range plans for increasing power capacity for aluminum, though short-term aids for the metals industry also will be sought. Purpose of the investigations is to assure aluminum in sufficient quantities for the needs of the nation's rearmament program.

At the first of the NSRB conferences last week (July 9), the group had little concrete data on aluminum requirements or production capacity, or on the probable power needs therefor. It was decided to canvass all these problems.

A staff aide of the Bonneville Power Administration presented an independent report which set the aluminum shortage "for peace-time needs" at 275,000 tons this year, at 375,000 tons by 1952. Translated into energy requirements, he asserted, this meant there was need for an additional 550,000 kw for aluminum production now and 750,000 kw by 1952. By 1953, he added, military aviation will require 100,000 additional tons of primary aluminum annually.

His report was accepted by Edward Falck, chief consultant of NSRB's Power and Utilities Division, for consideration by the task committee.

The 12-man task group is making preliminary investigations on three general points: locations, present condition, and operating potentials of aluminum potlines now idle; possibility of further curtailment of power for potlines now in operation; availability of Canadian aluminum and of power for its production.

Charles M. Custer of the Southwest Power Pool; E. S. Bundy, Buffalo Niagara Electric Corp; Walter Dreyer, Pacific Gas & Electric Co; H. J. Scholz, Commonwealth & Southern Corp, and Ben Creim, U. S. Bureau of Reclamation, were assigned to uncover data on idle potlines.

Barclay J. Sickler, Bonneville Power Administration, and R. A. Kampmeier, Tennessee Valley Authority, will make the principal studies of possible curtailment of energy now supplied for aluminum production. Other members of the task group will make checks of their system areas along the same lines.

J. E. Moore, Ebasco Services, will investigate the Canadian aluminum situation. In addition, Robert Wardle, NSRB staff consultant under Falck, will assist in checking Canadian output.

Other members of the task committee are V. M. Marquis, American Gas & Electric Service Corp; Robert Brandt, New England Power Co; Francis L. Adams, Federal Power Commission, and J. Warren McLaughlin, Munitions Board.

Also attending last week's initial conference were C. E. Bennett, FPC; Samuel Moment, BPA; Edward P. Eardley, Department of Interior; G. O. Wessenauer, TVA; F. H. Hayes, Department of Commerce; Lt Col C. C. Segrist, Department of the Air Force; Mark Eldredge and T. C. May, Munitions Board.

Tenor of the session was set by questions posed for the group by Falck. He asked that the committee specifically consider the possibility of meeting additional defense demands for aluminum through curtailment of civilian needs; where, and what types of new generating capacity, if any, would be needed; the responsibilities for supplying additional energy resting with the electric utilities, the aluminum industry, and the federal government; and the economic risks and difficulties involved in supplying more power for aluminum production.

The NSRB advisors also decided to revise the board's national power survey to make adjustments for new equipment orders placed by utility systems and changes in demand and other factors. Work on the revision, however, will not be started for at least another month.

•

FIRST WINNER of the J. E. North Award, W. E. Conley, district engineer, Lamp Department, Buckeye Sales District, General Electric Co, receives his award for his work in 1947 in promoting better lighting. The award is sponsored annually by the Electrical League of Cleveland in honor of J. E. North, general manager of the Cleveland Electric Illuminating Co and for 26 years president of the League. Left to right are League Vice-President W. E. Henges, Conley, North, and C. B. Gray, manager of the Buckeye Sales District, who accepted a similar certificate on behalf of the district

PEPCO Rate Increase to Apply to August Bills

Potomac Electric Power Co will apply its newly authorized $2,750,000 rate increase—its first since 1920—to August bills, company officials announced this week (July 12). The boost was approved July 8, by the District of Columbia Public Utilities Commission.

The Commission determined the increase to be "necessary to maintain the company in a sound financial position and to provide it with the heretofore determined fair and reasonable return of 5½% on its investment.

Surprisingly little opposition to PEPCO's bid for higher rates developed during the PUC's hearings on the case. Some labor organizations opposed any increase whatsoever, but the principal opposition came from federal and D. C. government representatives who demanded scaling down of the company's request for increases totaling $3,000,000. They suggested $2,633,000.

McGraw-Hill World News Photo

500-KV EXPERIMENTAL station at Chevilly, France, is inspected by CIGRE delegates

Europe's Progress with High-Voltage Systems Wins Americans' Respect

(*McGraw-Hill World News*)

AMERICAN DELEGATES to the International Conference on High Tension Systems (CIGRE), held June 24-July 3 at Paris, agreed that European nations had the jump on the United States in long distance high-voltage a-c systems.

European reports on progress made in ironing out the kinks in high-voltage a-c systems were the high spot of the conference according to U. S. delegates. They felt that U. S. electrical engineers would be able to learn a lot from European experience with these systems if they ever find it economical to install such systems themselves.

So far the Europeans haven't discovered any startlingly new technical approaches to the problems of long distance high-voltage transmission. But they have taken some long strides in practical applications of existing knowledge. The reason is simple. Many European countries, particularly France and Sweden, are rich in hydroelectric power but poor in coal. They are forced to transmit big blocks of energy long distances from their dams, frequently located in inaccessible mountainous regions, to their factories. This means high voltages.

Sweden's power problem is typical. W. Borgquist, director of general of the Swedish Power Board, told the conference that Sweden now is building a 380-kv system to be completed in 1951 (EW, April 10, Page 114). Sweden relies on hydro for over 50% of her electric power. Yet only 35% of the potential hydroelectric power now is being tapped. The remaining 65% is located in the mountainous north of the country, over 500 miles away from the southern industrial centers.

The Swedes are throwing up a series of power stations in the north. By 1955 these power stations will have doubled Sweden's available hydro. They would have to add 26 new 220-kv lines to the existing five to carry the load. They decided that it was cheaper to install higher capacity lines.

This Swedish project, when completed, will be the longest highest-voltage system in actual operation. U. S. delegates expect it to throw some light on long distance a-c transmission problems which have not been cleared up by test projects such as the Tidd 500-kv project in the U. S., and the 500-kv experimental station at Chevilly, France. The knottiest problems of long distance high-voltage a-c transmission center around reducing corona effects.

The French delegates, incidentally, hinted at the conference that France is playing around with the idea of installing an extensive 380 to 400-kv system. Swedish representatives said that there was a possibility of setting up in the not too distant future an inter-European 400-kv line if the French go through with their plans.

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New York Commission Approves L. I. Merger

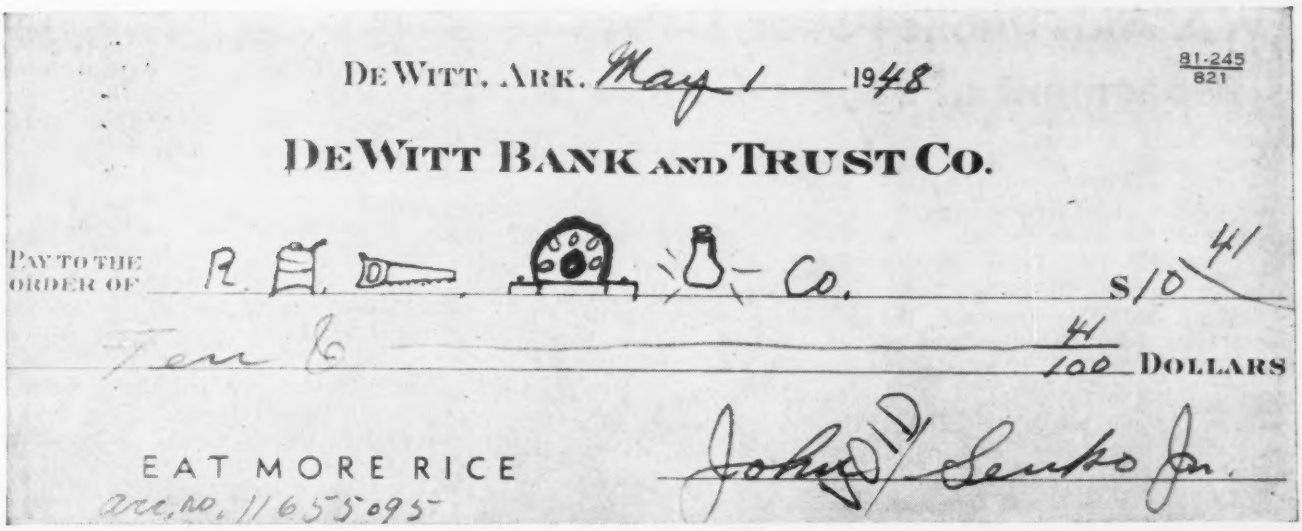
New York's Public Service Commission has approved unanimously a plan for consolidation of Long Island Lighting Co and two of its subsidiaries, Queens Borough Gas & Electrc Co and the Nassau & Suffolk Lighting Co. The remaining company, with assets of about $140,000,000, will be known as the Long Island Lighting Co.

The consolidation plan which NYPSC approved made no provision for any payment to holders of Long Island's common shares. An application for SEC approval proposed to pay 35 cents per share—a compromise between the New York commission's feeling that no basis exists for payments on the stock and SEC's position equity holders are entitled to some participation.

•

Penelec Raises Pay

Pennsylvania Electric Co has granted a pay raise of 12 cents an hour to 1,800 employees. The new contracts run until May 25, 1949. The International Brotherhood of Electrical Workers, AFL, represents 1,400 production and maintenance employees. The others are employees of the Eastern Division of the company. They are members of the Utility Workers Union of America, CIO. Employees not covered by union agreements will receive a similar increase.


DE WITT, ARK. May 1 1948

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DE WITT BANK AND TRUST CO.

PAY TO THE ORDER OF R. [illegible] Co. $10 41/100 DOLLARS

Fee

EAT MORE RICE

Acc. No. 1165-095

John D. Lenko Jr.

R CAN SAW POWER (&) LIGHT CO had no trouble in cashing this check of a customer in the rice-growing section near Stuttgart, Ark.

'Overtime-on-Overtime' Interpreted by McComb to Guide Employers

AN INTERPRETATION of the Supreme Court's "overtime-on-overtime" decision on which employers may rely in "good faith" under the portal-to-portal act has been issued by Wage-Hour Administrator William R. McComb.

Enforcement under the new principle established by the court, June 7, (EW, June 12, Page 4), has been delayed by McComb until Sept. 15.

The new rules will prevail until next year. Congress may then clarify the overtime pay question by special legislation or in the scheduled overall revision of the Wage-Hour Act which failed to get through this year. Also, there's a chance—not very good,—that the court might change its decision if it grants a rehearing of the June decision requested by the Justice Department.

In the meantime, here's how McComb analyzes the new overtime pay requirements:

The test of real overtime pay is "whether the payments are contingent upon the employee's having previously worked a number of hours or days specified as his bona fide standard daily or weekly working period."

With one exception, this means that extra pay for working nights, Saturdays, Sundays, holidays, or at any other hours considered undesirable is not "overtime." Such extra payments, then must be included in computing the employee's "regular rate." In addition, they may not be offset against time and a half due under the law after 40 hours a week.

The exception: The wage-hour administrator "will look not only at the terms of the applicable contract, but also at the actual practice of the parties under the contract" in determining whether a premium rate is being paid for time worked in excess of a bona fide standard (and thus true overtime) or for work at undesirable hours (and thus not true overtime.)

In other words, the fact that a labor contract may call for overtime pay for work on an undesirable day like Saturdays is not conclusive evidence that such extra pay is not real overtime. For, if the contract also calls for overtime after 40 hours and Saturday normally falls during overtime hours, the administrator will consider this sufficient showing that the time and a half on those days is actually paid for excessive hours of work. In that case it would be true overtime chargeable against that required by the law and need not be included in the "regular rate."

This exception is important in this way: take the employer whose labor contract calls for overtime pay on any Saturday work, but who normally operates only 40 hours, Monday through Friday. Actually, then, any work on Saturday would in practice be for excessive hours and, thus, the time-and-a-half paid on Saturday would be true overtime pay even though the employees may have worked less than 40 hours because of sick leave, a holiday, a vacation, lack of materials or other reason.

One word of caution: If a short work week due to lack of materials, for instance, became the rule rather than the exception, so that any Saturday work regularly fell within the 40-hour week, the administrator might not construe premium pay for Saturday as real overtime.

The above principles were written strictly from the Supreme Court decision. They have yet to be applied to specific cases. This will be done as requests for rulings on specific situations are received and answered by the Wage-Hour office.

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Los Angeles Will Build 3 Hydroelectric Plants

Los Angeles Water & Power Commission has voted a $40,000,000 bond issue to finance expansion of the city's electric system.

The projects planned are:

1. Three 37,500-kw hydro plants in the Owens River gorge at the upper end of Owens Valley.

2. A 250-mile. 230-kv transmission line from the third plant in the gorge to Receiving Station E in San Fernando Valley.

3. The raising of Long Valley Dam, which impounds Crowley Lake, 20 ft, increasing storage capacity from 183,000 to 315,000 acre-ft.

The three hydro plants will utilize the 2,375-ft power drop from Crowley Lake to the end of Owens gorge near Bircham's Canyon. They will be spaced to divide the power drop into three approximately equal heads. This project will entail the building of 58,000 ft of concrete lined tunnel and 18,500 ft of steel diversion dams below each of the plants for water regulation.

All projects are to be completed in 1951. The Commission made no announcement as to further expansion.

FWA Aids Public Power, Delays Repayment of Santee-Cooper Bonds

THE FEDERAL WORKS ADMINISTRATION has just done its bit for public power. FWA holds the bonds through which the South Carolina Public Service Authority financed its Santee-Cooper project. A $331,000 payment to the federal government to retire some of the bonds was due July 1. FWA postponed payment for five years.

The money was placed instead in a new capital improvement fund established by the Authority to finance a construction and replacement program. Present plans call for an addition of a small generating station at the Santee-Cooper project and transmission line construction. Total cost is to be $800,000.

FWA also approved the transfer of some $189,000 to the capital improvement fund from monies set aside for depreciation by the Authority in a special contingency fund.

"Any excess of costs of the planned facilities above the amount of the capital improvement fund and its accumulations will be paid from earnings (of the system)," the Authority's general manager, R. M. Jefferies, reported. Depreciation reserves will go into the construction fund each month, he added.

FWA officials, in announcing their approval of this arrangement, said that all construction work to be financed from the capital improvement fund would be subject to the approval of Federal Works Administrator Philip B. Fleming. General Fleming already has approved two projects, 33-kv transmission lines from Conway to Loris and from Myrtle Beach to Ocean Drive, all in South Carolina. These two lines, extending a total of approximately 38 miles, will cost about $300,000, Jefferies estimated.

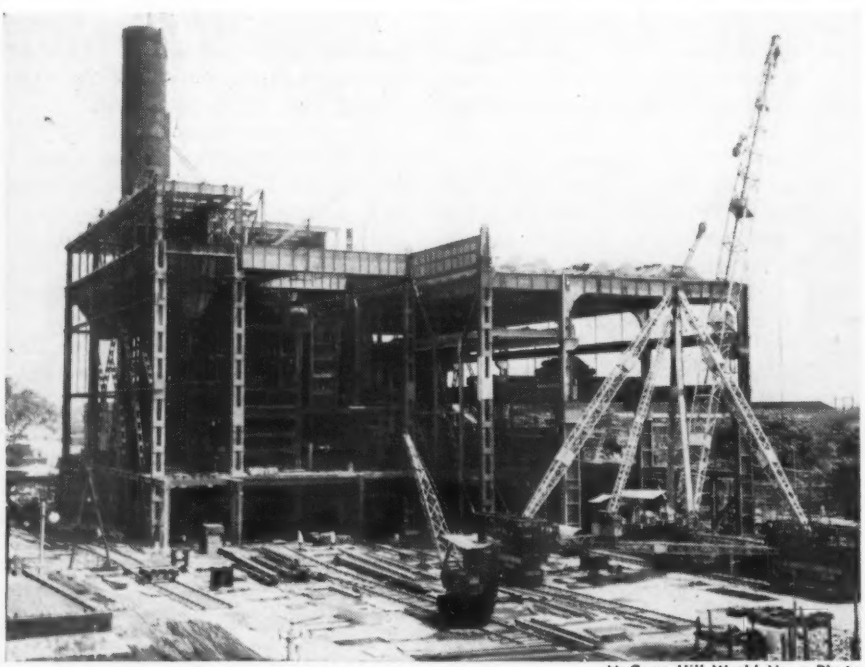
The new generating plant will be located at the spillway of the Santee Dam to utilize 500 cfs of water spilling into the Lower Santee River. Estimated cost is slightly more than $500,000.

Status of the state agency's debt to the federal government is not materially affected by the shuffling of Santee-Cooper's books, FWA spokesmen insisted. General revision of the 1939 trust indenture, under which the Authority was authorized to borrow up to $30,000,000 of federal funds, will be completed "later," they said. Jefferies predicted that final revision of the trust agreement, with rescheduling of bond maturities, will come "during the later part" of 1948.

Construction of the Santee-Cooper project has been financed by periodic issuance of bonds, FWA spokesmen reported. Some work on the project, including rip-rapping, still is being completed, they said. New power facilities now planned by the Authority will increase system revenues and thus improve the security of the federal investment in the project, they added.

The financial deal with FWA was arranged largely through the efforts of Alan Johnstone, who resigned as general counsel for that agency on May 30 to run for the Senate in South Carolina, it is reported. A long-time proponent of public power expansion, Johnstone is seeking to unseat Senator Burnet R. Maybank.

As chief legal advisor for FWA, Johnstone intervened in recent hearings before the Federal Power Commission to oppose the sale of South Carolina Power Co properties to South Carolina Electric & Gas Co. He supported the unsuccessful effort of the Public Service Authority to buy the utility and add it to the Santee-Cooper system.



McGraw-Hill World News Photo

INDIA'S LARGEST and most efficient thermal power station will be this at Cossipore, Calcutta suburb, when it is completed at the end of 1949. Two 30,000-kw units are to go into operation in the spring of that year. A 50,000-kw unit is to follow in December. Provision will be made to allow later installation of two more 50,000-kw units

Load, Capacity of Co-ops in Illinois Under Survey

An Illinois state-wide survey on cooperative loads and the capacity necessary to serve them is now being undertaken. The contract for the project has been let to Laramore & Douglass, Chicago consulting engineers, by the Association of Illinois Cooperatives. The basic purpose of the study is to determine whether or not a state-wide generating and transmitting cooperative is feasible. It is expected that the work will be completed within six months.

The study will forecast demands and consumption up to 1958. It will encompass existing supply sources and will also consider the possibilities of interconnection with TVA, the Dairyland Cooperative of Wisconsin, and other sources across state lines. The consultants will design one or more transmission systems tying the state cooperatives together. They will also develop the cost of building and operating a state-wide system and determine the cost of power as delivered to the individual.

Oregon PUD Loses Vote

A test of public power in Union County, Ore., brought defeat recently to a proposal that the county PUD acquire private utility lines serving Elgin and Island City. The vote was 221 to 162. California Pacific Power Co serves the area.

UNIVERSITY OF WASHINGTON'S $1,000,000 electrical engineering building at Seattle is ready for classes. The first floor houses laboratories and shops; the second and third, offices and classrooms in front, research laboratories in the rear wing; the pent-house, a radio transmitter. Features include facilities to furnish power to any room in the back wing, an impulse generator lab two stories high, study rooms, dumb-waiter service between laboratories, and an unusually large amount of window space.

Atoms Go Commercial; AEC Will Sell New Compounds at a Profit

COMMERCIALLY SPEAKING, atomic energy came of age this week.

The Atomic Energy Commission announced a program permitting commercial sale of chemical compounds and drugs tagged with radioactive elements. Approved experimenters will now be able to buy radioactive materials from commercial drug or chemical houses—instead of buying the basic elements from AEC and compounding them themselves or having it done for them.

This opens the way for the first time to direct entry of nuclear processes into ordinary business transactions.

During the interim period before commercial firms get into the field, AEC itself is going into the business of furnishing radio-compounds. To prevent this from retarding commercial entry, AEC intends to sell the compounds at prices which will yield a profit. And the Commission has committed itself to quit production of a compound any time a private firm is prepared to furnish it.

For about two years now, AEC has has been supplying experimenters with radioactive elements manufactured in its atomic reactor at Oak Ridge. These artificial elements are chemically and mechanically identical with the natural elements; but they emit radiation which can be detected with electronic instruments. This means a researcher can see clearly what's going on in all sorts of processes that he couldn't observe in any other way. However, an experimenter normally isn't interested in the behavior of simple elements. He wants to work with some complex material. Until now, he's had to synthesize the material himself from the elements furnished by AEC, or else he's had to arrange with someone to do it for him.

Under the new arrangement, an experimenter who needs radio-alcohol, for instance, will submit an application to AEC—telling how much he'll need over the next six months and what he wants it for. If AEC is satisfied he knows what he's doing and can handle radioactive material safely, it will authorize him to purchase the radio-alcohol from anyone in a position to furnish it. He must agree to publish his research results, but no restriction is put on his patent rights to any discovery.

The commercial supplier, under the program, can obtain radio-carbon from AEC at the same subsidized price ($50 a millicurie) which experimenters pay. He can then synthesize the carbon into whatever compounds he thinks there's a demand for, sell the compounds at any price he thinks proper. The only restriction upon him is that he may sell only to buyers who've been approved by AEC. This restriction is written into the Atomic Energy Act and could only be changed by Congress.

GE Turbine-Generator Output Tops 1947 Total

General Electric's Schenectady turbine plant during the first six months of 1948 produced turbine-generators with a combined kilowatt capacity greater than that of all units manufactured at the plant in 1947, a high production year, J. W. Belanger, manager of the company's Turbine Divisions, has announced.

In the half-year period ended June 30, 30 units representing 1,237,500 kw were built and tested. Some of these units already have been and others soon will be installed by utility companies in 16 of the 48 states and in France. Thirty-four turbine sets with a total capacity of 1,173,750 kw were shipped out of Schenectady last year.

Belanger pointed out that only six times since the first commercial turbine was built by the company in 1903 has the plant equalled or bettered its 1947 production record in turbine-generator sets for power companies.

Based on this record half-year performance, he predicted the plant would turn out more than 1,500,000 kw of turbine-generators during the last six months of 1948. He anticipated that in July alone turbines with a total capacity in excess of 400,000 kw will be completed.

"Our production of turbine-generator units for power plants by the end of 1948," he said, "is expected to reach 2,800,000 kw, which will exceed by more than 1,000,000 kw the figure for any previous year in the Schenectady plant's history."

Production of lower-rated turbine-generator units at the company's Lynn (River Works), Mass., plant also is continuing at an accelerated pace. Units totalling 268,250 kw were built and shipped during the first six months of 1948.

Belanger also stated that production of a new line of mechanical-drive turbines announced in May is progressing and that quantity shipments will begin in September. These units and other mechanical-drive turbines and small auxiliary turbine-generator sets are built at GE's Fitchburg, Mass., plant.

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Bans Electricity for Ads

Use of electricity for advertising signs has been banned in Japan by the Ministry of Commerce and Industry as a conservation measure. A recent dry spell has reduced production of hydro power. Industrial "electricity holidays" are planned for the future.

Energy Sales in March Rose 12.4% Over '47

Sales of electric energy to ultimate customers in Mar 1948 totaled 19,969,400,000 kwhr, the Edison Electric Institute reports. This was a 12.4% increase over the 17,771,930,000 kwhr sold in Mar 1947.

Revenues from ultimate customers amounted to $354,599,500, compared with $313,073,500 in Mar 1947, an increase of 13.3%.

For the 12 months ended Mar 31, the average use per customer advanced to 1,479 kwhr from 1,358 kwhr for the preceding year, an increase of 8.9%; the average annual bill to $45.11 from $43.05, an increase of 4.8%; revenue per kwhr dropped to 3.05 cents from 3.17 cents, a decrease of 3.8%.

Classification of Sales, March

Kilowatthour Sales March	Million Kwhr 1948	1947	Percent Change
Residential or domestic...	4,391	3,727	+17.8
Rural (Distinct rural rates)	458	320	+43.4
Commercial or industrial			
Small light and power..	3,497	3,026	+15.6
Large light and power..	10,197	9,285	+ 9.8
Street and highway lighting	214	200	+ 6.5
Other public authorities...	531	491	+ 8.2
Railways and railroads			
Street and interurban..	382	434	—11.9
Electrified steam railroads	240	239	+ 0.4
Interdepartmental	59	50	+17.5
	19,969	17,772	+12.4

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Foreign Copper Needed by American Industry

The importance of foreign copper to American industry was indicated recently by C. Donald Dallas, chairman of Revere Copper & Brass, Inc, in a letter to Rep William Lemke. The Congressman is chairman of the subcommittee on mines and mining of the House Committee on Public Lands. This subcommittee is investigating needs and sources of mineral supply.

Dallas declared at the present rate of industrial consumption, there is an annual deficit of 500,000 tons of copper. This can be met only by imports. Even if civilian use should be cut to a minimum, there would still be a deficit.

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To Add 2 Steam Units

Alabama Power Co plans to install a 60,000-kw unit at its Gorgas Plant and a 40,000-kw unit at its Mobile Plant. Both are steam plants.

WALKER L. CISLER, left, consultant to Administrator Paul Hoffman of the Economic Cooperation Administration, welcomes C. W. DeForest, his deputy, who will go to Paris to screen requests for power equipment by Marshall Plan nations

GE Secures Injunction Against Appliance Dealers

Motions for temporary injunctions against eight New York City appliance dealers who were charged by the General Electric Co with selling GE appliances below the fair trade prices have been granted by Justice Edward R. Koch, of the Supreme Court, New York County.

The cross motion to dismiss the General Electric complaint that was made by Monarch-Saphin Co, one of the defendants, was at the same time denied by the court.

The dealers temporarily enjoined pending final decision in the cases were: Benco Sales Co, Bondy Distributors, Inc, Buy Wise Merchandise Co, Central Sales Supply Co, T. A. Gary, Heins & Bolet, Monarch-Saphin Co and Silken Shopping Service.

In a similar action started simultaneously with the others, Dranke Home Appliances, Inc, consented to a permanent injunction Mar 15.

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Power Train Returning

The Navy is getting back one of its mobile power trains. The Mexican government expects to send back to the Philadelphia Navy Yard about Aug 1, the train that has been operating in the Guanajuato region since Feb 22, 1947. A 10,000-kw steam plant has been erected near Celaya to relieve the power shortage which was caused by a drought. The Navy's other power train will remain at Tempe, Ariz., until Oct 1.

SEC RULINGS

MONONGAHELA SECURITIES Co and its subsidiary Monongahela Transport Co, have been allowed to liquidate and dissolve. The assets of both companies will be transferred to Monongahela Power Co, parent of Monongahela Securities. All three companies are located in Fairmont, W. Va., and are a part of the West Penn Electric Co system. (Release No. 8307).

KANSAS GAS & ELECTRIC CO's proposal to amend its certificate of incorporation in certain respects has been approved. The utility proposes: (1) to include an express provision for cumulative voting whereby a stockholder of record entitled to vote at an election of directors may cast one vote for as many persons as there are directors to be elected, or he may cumulate such votes and give one candidate as many votes as will equal the number of directors to be elected, multiplied by the number of his shares of stock, or he may distribute them among as many candidates and in such manner as he shall desire; (2) to include a provision granting limited preemptive rights to holders of common stock whereby such holders, in the event that new or additional issues of common stock are disposed of for money at other than a public sale, shall have the right to subscribe for new and additional issues of common stock on a prorata basis upon terms not less favorable to the purchaser than those on which the board of directors issues and disposes of such stock to others; and (3) to include a provision requiring that the consideration received from the issue and sale of additional shares of common stock without par value be entered in the capital stock account. (Release No. 8317).

MEETINGS

American Institute of Electrical Engineers—Pacific General Meeting, Davenport Hotel, Spokane, Wash., August 24-27; Middle Eastern District Meeting, Statler Hotel, Washington, D. C., October 5-7. H. H. Henline, secretary, 33 West 39th St., New York 18, N. Y.

International Brotherhood of Electrical Workers—Annual Convention, Ritz-Carlton Hotel, Atlantic City, September 13-17. J. Scott Milne, secretary, 1200 15th St. NW, Washington, D. C.

Instrument Society of America—National Instrument Conference and Exhibit, Philadelphia Convention Hall, Philadelphia, September 13-17. Richard Rimbach, executive secretary, 1117 Wolfendale St, Pittsburgh 12, Pa.

Iowa Utilities Association—Conference, Fort Des Moines Hotel, Des Moines, Iowa, September 20-21. William R. Blake, secretary-manager, 606 Fleming Building, Des Moines 9, Iowa.

Illuminating Engineering Society—National Conference, Statler Hotel, Boston, September 20-24. A. D. Hinckley, executive secretary, 51 Madison Ave, New York 10, N. Y.

International Association of Electrical Leagues—Annual Conference, Mayflower Hotel, Washington, D. C., September 29-October 2. O. C. Small, secretary, 155 East 44th St, New York 17, N. Y.

Canadian Electrical Manufacturers Association—Annual General Meeting, General Brock Hotel, Niagara Falls, Ont., September 30-October 1. Roy D. Kerby, general manager, 126 Davenport Road at Belmont, Toronto 5, Ont.

April Canadian Output Sets Mark for Month

April reversed a downward trend in Canadian power production that began in January. For three months output of Canadian central stations was less than that of a year previous. But April's 3,733,137,000-kwhr total was slightly higher than the 3,727,377,000 kwhr of April, 1947. It also was a record high for April.

Output for the first four months was 14,750,420,000 kwhr, slightly below the 15,124,754,000 kwhr in the corresponding period in 1947.

Consumption of primary power continued high. For the twenty-first successive month, such consumption topped that of the corresponding month a year previous. April consumption was 3,324,393,000 kwhr, for the first four months, 13,371,254,000 kwhr.

The following production statistics, supplied by the Dominion Bureau of Statistics, are in thousands of kilowatt hours:

Period	1948	1947
Four months	14,750,419	15,124,754
Primary	13,796,714	12,579,892
Secondary	953,705	2,544,862
Exports to U. S.	517,265	689,654
April	3,733,137	3,727,377
Primary	3,431,725	3,119,657
Secondary	301,412	607,720
Exports to U. S.	153,738	186,580
March	3,764,129	3,956,905
Primary	3,577,853	3,268,469
Secondary	186,276	688,436
Exports to U. S.	124,758	183,125

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Greater Depreciation Rate Sought by Utility

Arkansas Power & Light Co has asked the Arkansas Public Service Commision for greater allowances for maintenance and depreciation to meet higher costs.

Under a policy adopted in 1944, AP&L is permitted to deduct $1,600,000 annually for maintenance and depreciation on all equipment owned on Dec 31, 1943, plus 3% of cost for equipment added after that date. The utility wants these allowances changed to $2,000,000 and 3.75%.

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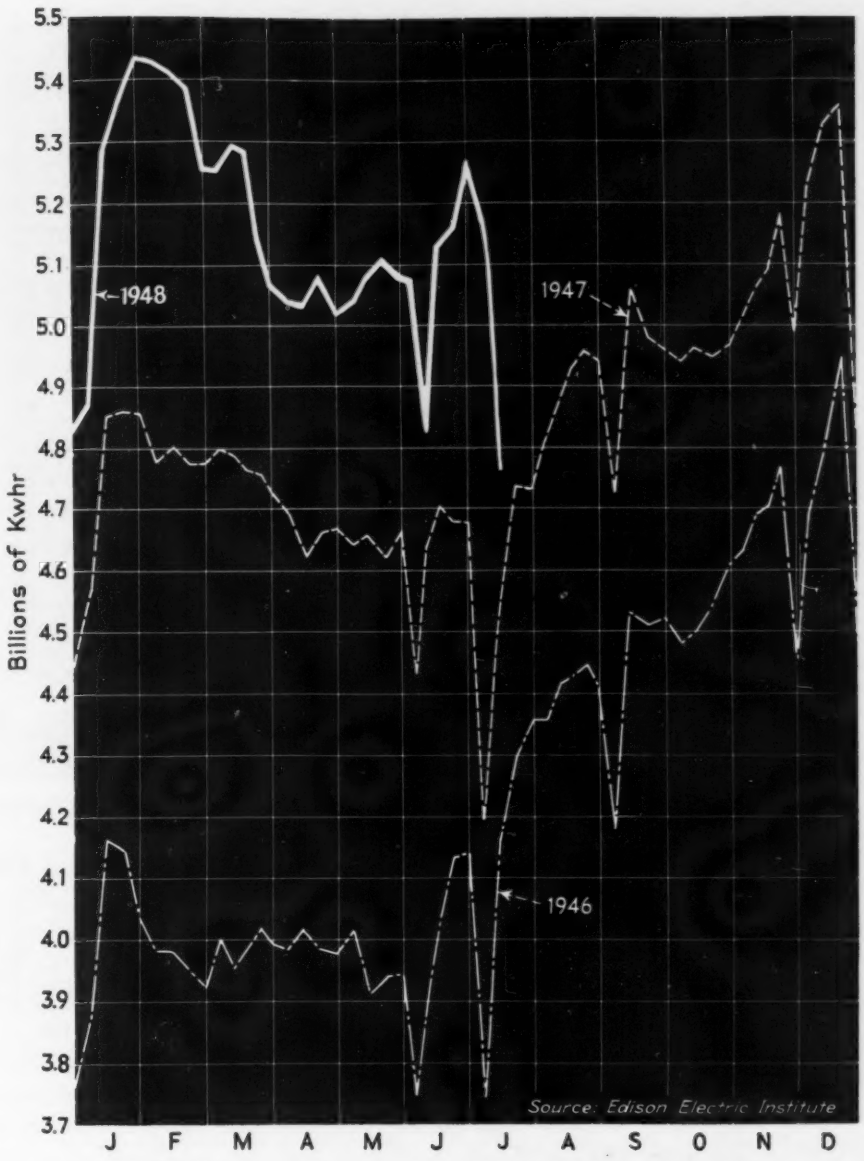
40,000-Hp Plant Planned

Mississippi Power Co is planning a $4,000,000 steam electric generating plant to be located in Lauderdale County near Meridian. Although the plant, as now designed, is for one 40,000-hp unit, additional capacity may be installed. The turbine is scheduled for delivery in February, 1951, with the plant in operation by the summer of that year.



O'Mahoney Yearns and Turns to Be V-P

"It's a wonderful world," sighed ARPUT. "He ought to be happy, but here's Senator O'Mahoney crying because the steel business has junked basing point pricing. Strictly a swindle, he says."

O'Mahoney DISTURBED about THAT?

"Absolutely," said ARPUT. "And isn't it funny how much a man can yearn to be Vice-president? A decade ago, O'Mahoney was chairman of the Temporary National Economic Committee. One of its big recommendations was the end of basing point. Now that the steel business ends it—earlier and with less litigation than there might have been—O'Mahoney says it's a dirty deal. That sends his reputation for objectivity down farther than the output went last week."

Other News

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Weekly Output, Millions Kwhr

1948	1947	1946
July 10 4,760	July 12 4,531	July 13 4,156
July 3 5,166	July 5 4,190	July 6 3,741
June 26 5,257	June 28 4,675	June 29 4,133
June 19 5,159	June 21 4,676	June 22 4,129
June 12 5,132	June 14 4,702	June 15 4,030
June 5 4,845	June 7 4,635	June 8 3,920
May 29 5,076	May 31 4,429	June 1 3,741
May 22 5,085	May 24 4,663	May 25 3,942

Percent Change from Previous Year

		July 3	June 26
New England	−10.1	+42.7	+ 9.4
Mid-Atlantic	+ 1.3	+19.8	+10.4
Central Industrial	+ 2.6	+28.1	+13.4
West Central	+13.1	+25.3	+16.4
Southern States	+11.4	+23.8	+17.0
Rocky Mountain	− 0.2	+ 7.8	+ 7.3
Pacific Coast	+ 7.3	+16.6	+ 6.8
Total United States	+ 5.1	+23.3	+12.4

WASHINGTON COMMENT

WILLIAM B. WHICHARD

WASHINGTON'S hesitant movement toward a revival of some war-time controls for industry died quietly at the White House—of all places—a few days ago. The last and probably fatal blow was President Truman's decision not to use the only real controls voted him by Congress—an authorization to allocate steel for military orders.

Even this small concession was granted in what might be termed an unintentional lapse by a Congress which previously had balked at anything more than a shadow of industrial controls. In last-minute action on the new draft law, when Congress was rushing toward adjournment, a House bloc rammed through amendments designed to give small business a share of military supply orders. To insure small firms of a source of raw materials, a proviso was included to permit allocation of steel to munitions makers. The proposal was hastily adopted.

Truman quickly backed away from the new authority. Instead of exercising it, he directed the Department of Commerce to get steel for arms through voluntary agreements with industry.

Commerce Department's voluntary allocation programs thus remain the sole operative approach to any form of industry controls. The results obtained therefrom have been something less than impressive.

When the voluntary programs were authorized by the special session of Congress last winter, there were high hopes for it. True, it fell far short of the comprehensive control program demanded by the President, and even of the suggestions of some Republican Congressional leaders. But there was reasonable expectation that government-industry conferences on supply bottlenecks might develop means of stepping up production. It was a reasonable supposition at that time.

It just didn't work out that way. Everyone was ready to suggest allocation programs for industries other than his own. Nobody—either in government or industry—wanted the responsibility for shutting off supplies to what might be designated as non-essential, or less essential, demands for raw materials and finished products. There were other snags, but this was the most important.

Behind the collapse of most attempted allocation agreements was the shift in the international situation. Last winter Washington and most of the rest of the country was disturbed over the possibility of another war. As a result, rearmament was hastily started. Its effects, plus those of European relief requirements, on the national economy led to serious demands for industry controls.

Rightly or wrongly, Washington since has become convinced that war is not imminent. With the improvement in the international situation, the pressure behind moves to gear the economy to war production has slacked off.

Some form of controls is still desired in some administration quarters to aid military stockpiling. And some may be needed to help expand production of military equipment if requirements continue to mount. But it is likely to take another war scare to sell Congress and industry the idea again.

TECHNICAL TRENDS

ARCHER E. KNOWLTON

Pulverization of anthracite to 200-mesh to extent of 95% is too costly a way to get a clean stack. Removal at and return from the stack for a second exposure to combustion is being found superior.

Apparatus temperatures in enclosures may run disadvantageously high if anything impedes the natural ventilation or contacts are not good.

Contact polarity reversal at intervals has been found effective as a means for prolonging life of dc contacts on interconnection totalizing metering of the impulse type.

Unorthodox polyphase meter connections can be very errorsome. The British found that 30% of the grid interconnection metering was garbled.

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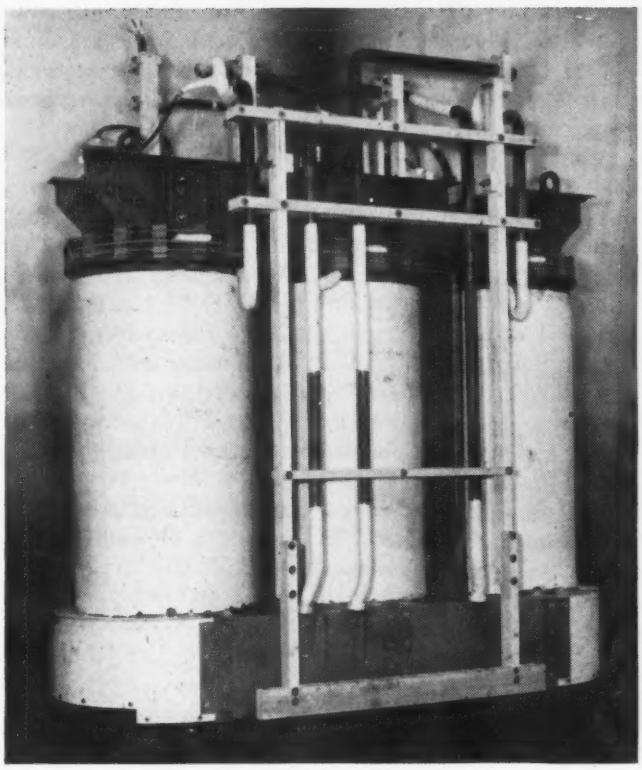
Power plant warehouse stocks for repairs and replacement may run to 3,000 or more different items; 50 to 75 sizes of pipe, 400 types and sizes of valves, let alone 500 varieties of bolts, paints, tool and janitor supplies. Orderliness, records and means for the handling of the heavier pieces are essential to expeditious and competent maintenance.

Three-phase transformers are economical and warranted today *without* a spare where it used to be 3 single-phase units *with* a spare. Mobile substations, surer protection and better transformers are making the change in practice more and more feasible and attractive.

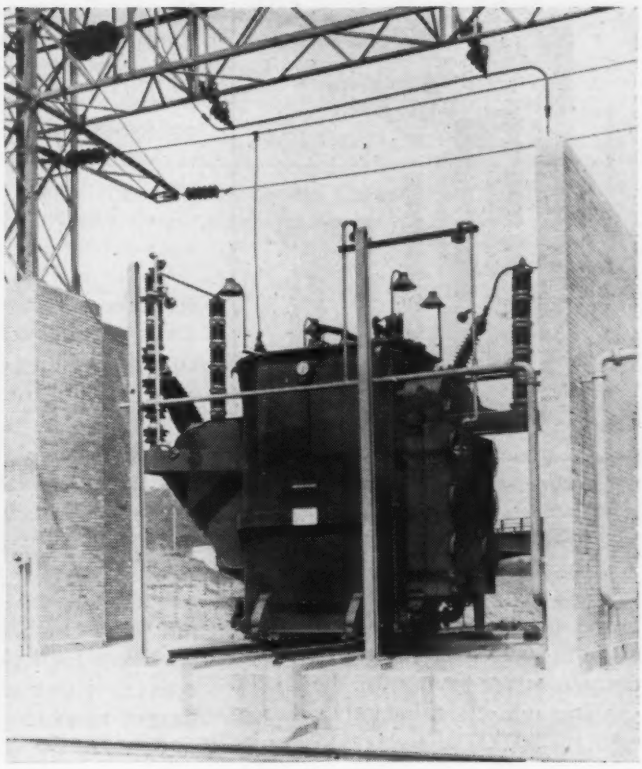
Circuit breaker barriers of non-climable design are being used on all energized breakers of a company determined to curb the risk of doing maintenance on the wrong unit. The barrier is only removed as part of the hold-off procedure for a de-energized breaker.

Compression splices have much to commend them for permanent connections and the full benefits call for use of a compression tool at the pole-top.

Carbon-steel pipe that has become graphitized by welding can be normalized by 3-hour induction heating to 1700 F followed by 700 F and then 1250 F. The sequence diffuses the graphite.



CORE AND COILS of a forced-oil-air cooled power transformer rated 20,000 kva, 110,000 to 13,800 volts



FORCED-OIL-AIR COOLED single phase power transformer rated 35,000 kva

Modern Transformers Are Money Savers

J. W. BUTLER
Transformer and Allied Product Divisions
General Electric Co
Pittsfield, Mass

ANY ANALYSIS of trends in transformer design and application that takes account of power transformer prices, accents certain practices that deserve emphasis from the standpoint of engineering economics.

Among these, the trend toward forced-cooling seems to be the most significant. Adoption of 3-phase transformers, the reduced-insulation philosophy and elimination of hand taps on large step-up units are others that could be more widely accepted to reduce capital expenditures during the present period of utility system expansion.

In examining these practices, this article will establish three major points:

1—That there is a definite trend toward forced-cooling of power transformers and that important economies are being effected through its use. Characteristics of forced-cooled transformers can be readily fitted into overall system requirements.

2—That the reduced insulation philosophy is sound. Ability of modern arresters to reliably limit transient voltages should be utilized by system designers to effect economies in power transformers.

3—That proper coordination of the turn ratio of step-up transformers permits full utilization of generator regulation ability within its rating. This will permit hand-controlled taps to be eliminated at an attractive saving in the transformer price.

Forced Cooling

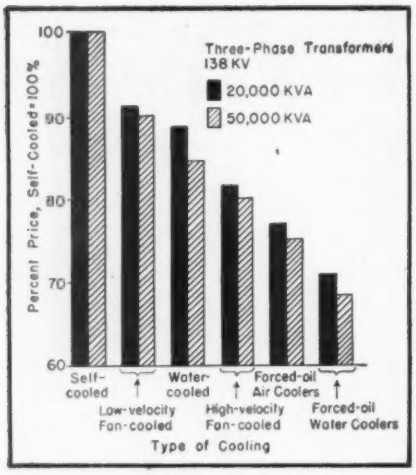
Forced cooling includes transformers using:

1—Fans to force air at high velocity through radiators. Oil in the radiators flows under its own thermal head. Such a transformer has a self-cooled rating of 60 % of its forced-cooled rating.

2—Directed forced-oil flow within the windings and external heat exchangers. The heat exchanger may be either forced-air-cooled or forced-water-cooled. Such transformers have no self-cooled rating.

The forced-cooling principle is based, fundamentally on the substitution of electric power for material and labor by the designer. Since in general, transformer loading is limited by the temperature of its core and coils, the kva loading per pound of material can obviously be increased by speeding up the flow of cooling medium that carries away heat.

A review of General Electric transformers on order above 15,000 kva, using all types of cooling, showed that the average size of forced-cooled units was the largest. The average size was so large that it raised the question as to why. The most logical explanation was that more *dollars*



RELATIVE PRICES of 20,000 kva and 50,000 kva three-phase 138-kv transformers with different types of cooling

were saved in the larger units than in the smaller ones. This, of course, made them look more attractive. But the *percentage* saving for the 20,000 kva size is not significantly different from the 50,000 or 100,000 kva units.

Choice Of Cooling

The accompanying price chart shows that forced-cooled transformers are the lowest-price transformers available. This fact should impel planning and operating engineers to scrutinize and evaluate the difference between the operating characteristics of transformers using the various types of cooling very closely. Present pressure to produce lower cost energy makes such evaluations imperative.

LOSSES: Total losses of forced-cooled transformers are today about 150% of corresponding self-cooled units. But core losses are only about 80% of self-cooled values. However, about 60% core and coils with forced-cooling does the work of 100% core and coils in a self-cooled unit. This means lower core-losses, higher copper-losses and corresponding price savings. Fuel and operating costs have also risen, so the desirability of higher loss and lower cost equipment has not necessarily decreased.

To crystallize this thought, consider the analysis of Table I in which losses of 20,000 kva forced oil, air-cooled transformer are capitalized at \$400/kw for iron and \$200/kw for copper.

With \$5.85/kva total capitalized cost for self-cooled and \$5.48/kva for the forced-cooled, Table I shows that for a 20,000-kva, 3-phase transformer it is practically a stand-off between self and forced cooling, even with the extra high loss evaluation of \$400/kva for iron and \$200/kva for copper. However, installation costs were not included. These are greatly in favor of the forced-oil-air unit, as will be shown.

While power requirements for forced-cooling are not serious it may be desirable to include them in a study. The following are maximum values:

IMPEDANCE: The impedance of standard forced-cooled transformers is higher than self-cooled units of the same rating. Forced-oil-air impedance is 150% and forced-air 167% of the self-cooled transformer. This means a standard impedance of about 15 to 16% for higher-voltage units. At the generating station the effects of high impedance on voltage regulation and kvar requirements are generally valued at a minimum because at the station these items are available at a lower cost than anywhere else on the system. Modern generators can deliver rated output at a voltage ± 5% from normal. This should be enough range to take care of most regulation through the transformer under high power-factor operation. Voltage drop in the transformer should not be a problem because very little reactive kva can be shipped economically out of the station for transportation over the high-line, and reactive kva accounts for practically all the regulation in the transformer.

For example, a transformer with 15% IX and 0.6% IR will have the following regulation:

Input P-F	Percent Regulation
1.0	1.7
.95	6.1
.90	8.0
.85	9.1
.80	10.2

These figures show that regulation at high power-factor is very good and that high reactance need not necessarily prevent taking advantage of the other economies.

If lower impedance is imperative for such reasons as system stability, a forced-cooled unit can be obtained for about half the price difference between the two.

Higher impedance transformers further tax kilovar sources, since the kilovars due to transformer I^2X are just as "real" as load kilovars. However, capacitors can supply these extra kilovars at a cost that is much lower than the cost of reduced reactance. The capacitors, moreover, can be located in the distribution system where maximum benefits are derived.

INSTALLATION: Field assembly work on a large self-cooled transformer is 10 to 20% of the initial transformer price. This contrasts with 2 to 4% for a forced-oil-air-cooled unit. These savings are possible because large forced-oil cooled

TABLE I—Economic Comparison of Self-Cooled and Forced-Oil-Air Cooled Transformers

Rating: 20,000 Kva three-phase, 138 Kv-13.8 Kv. Std. Taps and Accessories.
Loss Evaluation: Fe \$400/Kw Cu \$200/Kw

Type of Cooling	Kw Loss Cu	Kw Loss Fe	Kw Loss Total	Approximate Transformer Price
Self	97	49	146	\$3.90/kva
Forced-oil-air	172	38	210	\$3.00/kva

Self-Cooled

Fe 49 × (\$400) = \$19,600
Cu 97 × (\$200) = 19,400
\$39,000

Total Capitalized Cost
\$3.90 per kva price
1.95 per kva losses
\$5.85

$\frac{\$39,000}{20,000}$ = \$1.95/kva capitalized losses

Forced-oil-air

Fe 38 × (400) = \$15,200
Cu 172 × (200) = 34,400
\$49,600

\$3.00 per kva price
2.48 per kva losses
\$5.48

$\frac{\$49,600}{20,000}$ = \$2.48/kva capitalized losses

TABLE II—Power Requirements For Forced-Cooling

Type of Cooling	Power Requirements In Percent of Total Losses at Max. Rating
Forced-air low-velocity (1/1.25)	2%
Forced-air high-velocity (1/1.67)	5%
Forced-oil-air	5%
Forced-oil-water	3.5%

units can be shipped more nearly assembled. Table III emphasizes this point:—

TABLE III(a)—Approximate Shipping Limitations

Type Cooling	Completely Assembled	Bushings Removed	One-Piece Tank Coolers and Bushings Removed
Self.....	5,000 kva– 69 Kv	7,500 kva	60,000 kva
Forced-oil-air.....	40,000 kva–115 Kv	120,000 kva–115 Kv	120,000 kva plus

TABLE III(b)—Comparison of Physical Characteristics (60,000 kva, 69-kv, three-phase transformer)

Type Cooling	Height (in.)	(sq. in.) Floor Space	Weight (lbs)
Self.....	222	72000	220000
Forced-oil-air.....	222	30200	150000

Fan-Cooled Transformers

A few additional points apply specifically to the forced-air cooled transformer. Shipping is not as simple as with forced-oil-cooled transformers since radiators and fans must be removed on 3-phase ratings above approximately 12,500 kva.

Since high-velocity fan-cooled transformers have a self-cooled rating that is 60% of top rating, they can still carry load when auxiliary power is completely lost. Forced-oil-cooled units cannot. This seems to influence their use in unattended stations. However *if* cooling equipment or auxiliary power is equal or more reliable than the core and coils themselves, the self-cooled rating cannot necessarily be considered any more firm than the top capacity. The fact remains that no oil pump or fans have ever been responsible for shutting down a forced-cooled unit. However the industry seems to be accepting fan-cooled transformers with self-cooled ratings more readily in the unattended areas.

Applications are infrequent where transformer taps are left out entirely. But it has been done and it is felt that it can be justified a lot more. The large transformers at Hoover Dam have no taps. Two 100,000-kva forced-oil-cooled units being built for a large eastern utility have no taps. Several smaller installations are going in without hand-controlled taps. There is a 4% saving in the base price affected by this omission.

With such modern analytical methods as the a c network analyzer available for predetermining system performance there is no longer the need to provide transformer taps for contingencies that there was formerly. In large step-up transformers occasionally a utility engineer will specify as many of the four 2½% standard taps below normal to get more copper in the windings. If two 2½% full-capacity taps below normal are specified there is 5% more copper in the tapped winding than there would be if the taps were above normal.

Proper coordination of the generator voltage rating with the transformer primary winding voltage rating is necessary if both pieces of equipment are to operate within their prescribed ratings. This problem and its solution is illustrated by the following case of a 13.8-kv generator and its associated step-up transformer to 115 kv.

ASA Rating Standards

Generator—13.8 kv ± 5% at rated kva and p.f.

Transformer—115 kv + 5% at rated kva and 0.8 p.f.

CASE I—Step-up transformer rated 13.8 kv — 115 kv.

(a) To get 115 kv + 5% at rated kva at 0.8 p.f. approximately, 13.8 Kv + 10% or more will need to be applied to the primary. This is above the generator rating.

(b) Current rating of 13.8-Kv winding = 100%

CASE II—Step-up transformer rated 13.2 Kv — 115 Kv.

(a) To get 115 Kv + 5% at rated Kva and .8 p.f. approximately 13.2 Kv + 10% (about 13.8 Kv + 5%, the generator rating) will need to be applied to the primary.

(b) Current rating of 13.2 Kv winding = 105% of 13.8 Kv winding in Case I.

Thus, the step-up transformer should have a primary winding voltage rating of about 5% below the generator voltage rating. This goes a long way in allowing the generator to compensate for the voltage and kvar loss in the transformer.

In transformers 115 kv and higher the philosophy of dropping down one insulation class at the line end, grounding the neutral and allowing a still lower insulation class at the neutral end is a sound trend. It presupposes the use of closely-coupled lightning arresters of the grounded-neutral rating. This practice not only gives an attractive price saving, but a lower reactance at the standard price. On some systems where long distance transmission and hydro stations are involved, lower reactance may be needed to improve system stability. In steam stations on the other hand where generators have low reactance, transformers with low reactance may be undesirable due to the increase in short circuit requirements.

Where stability is a real problem special low-reactance generators are sometimes purchased. It can be shown that low overall system reactance comes for less money in transformers by using reduced insulation at both line and neutral ends. What this means is shown by the two cases of Table IV. These cases show that substantial price savings are obtainable together with lower impedance which in turn means lower losses.

TABLE IV—Base Price and Impedance Comparison with Reduced Insulation

		Fully Insulated		Next Lower Insulation Class With Grounded Neutral Insulation	
	Type of Cooling	138 KV	230 KV	115 KV	196 KV
Base Price	Self.....	100%	100%	86%	75%
	Forced-Oil.....	100%	100%	83%	75%
	Forced-Air.....	100%	100%	84%	75%
Minimum Standard Impedance	Self.....	8 1/2%	11%	7 1/2%	9%
	Forced-Oil.....	12 3/4%	16 1/2%	11 1/4%	13 1/2%
	Forced-Air.....	14 1/6%	18 1/3%	12 1/2%	15%

Petersen Coil Tuning Determines Performance

Ground fault neutralizers on 36 kv system in Indiana cuts line tripouts and reduces equipment damage. Staged line-to-ground tests confirm optimum tap settings determined from measurements of residual current

H. W. HARTZELL
Technical Engineer
Commonwealth & Southern Corp
Jackson, Mich.

S. S. COOK
Transformer Engineer

and

A. A. JOHNSON
Central Station Engineer
Westinghouse Electric Corp
East Pittsburgh, Pa.

SELDOM HAS THE CASE for an installation of Petersen coils been so well documented as the two recently placed on the 36-kv system of the Southern Indiana Gas and Electric Company.

The history of this installation, covering system operation (1) with the neutral isolated from ground, (2) with the neutral grounded through a temporary tuned neutral resistance and (3) with two new ground fault neutralizers (Petersen coils) in operation, is discussed herein. Tuning tests and measurements during staged line-to-ground faults were made after the installation was completed and are reported herewith in this article.

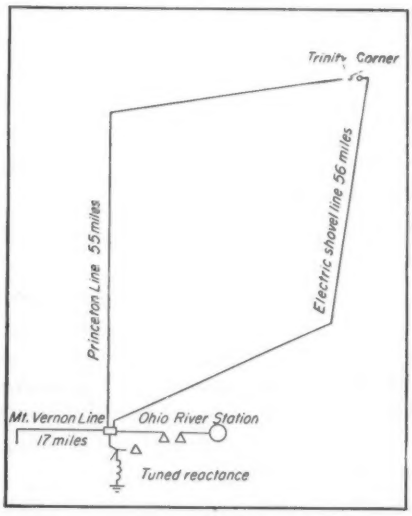


FIG 1—36 KV SYSTEM showing initial tuned reactance installation

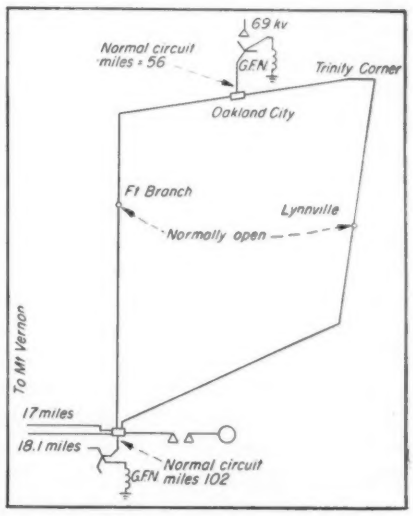


FIG 2—PRESENT arrangement with two ground fault neutralizers

Seven conclusions can be drawn from experience with this installation:

1—The ground fault neutralizer, or tuned neutral reactance, reduces total line tripouts by 30 to 35 percent even though lines are of wood pole construction without ground wires and without ground wires down the poles.

2—Ground fault neutralizers reduced the number of equipment failures.

3—Ground fault neutralizers will operate satisfactorily for line-to-ground faults even when out of tune by several tap positions.

4—The "in tune" tap for rainy weather is lower in ohms than for clear weather.

5—Neutralizer "in tune" tap can be found under "no fault" conditions by finding the tap that gives maximum neutralizer current.

6—The "in tune" tap can also be found by measuring the frequency of current decay through the neutralizer after a fault has been cleared.

7—It is hard to determine "in tune" tap by measuring fault currents.

TABLE I—Staged Line-to-Ground Fault Tests

Test No.	Tap No.	G.F.N. Ohms	Gap Inches	Arcing Time Cycles	Amperes During First Half Cycle GFN Current RMS Sine Wave	GFN Current Peak	Fault Current D-C	Fault Current Peak
56 Miles of Circuit—Optimum Tap Number 5								
100	5	1631	9.5	5.5	14	37	17	23
101	8	1280	9.5	4.0	22	63	25	....
102	11	1042	9.5	3.0	26	75	35	....
103	11	1042	4.1	28	20	....	....	....
105	5	1631	4.1	9.5	13	28	11	30
106	3	2005	4.1	10	11	32	13	....
107	1	2520	4.1	11	8	15	3	....
108	5	1631	4.1	3	13	26	9	23
158 Miles of Circuit—Optimum Tap Number 23								
109	23	565	4.1	6.5	....	320	....	240
111	25	523	4.1	1.0	....	135	....	....
112	21	618	4.1	5.0	45	110	....	....
113	19	678	4.1	12.5	55	190	....	210
114	23	565	4.1	0.5	32	41	4	58
117	23	565	4.1	7.5	....	185	....	150

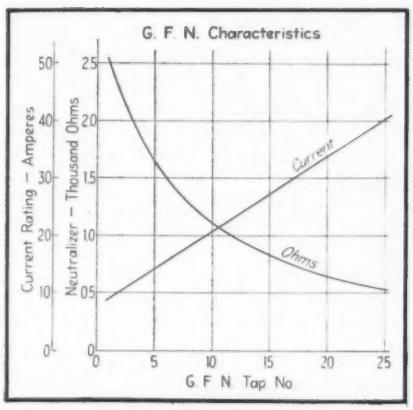


FIG 3—CHARACTERISTICS of ground fault neutralizers installed on Indiana system. Curves show reactance ohms and maximum current vs tap position

Growth of Southern Indiana's ungrounded 36-kv system accented the operating problems typical of this type of system. Voltage near the ends of long lines became inadequate. The high sending-end voltage required, caused bushing and insulator flashovers and arrester failures under single line-to-ground faults.

The system, Fig. 1, consisted of three radial lines totaling 128 miles fed from Ohio River Station. The so-called Princeton and Electric Shovel lines formed a loop, normally open at Trinity Corner. Automatic switching was performed at Ohio River station only.

A temporary scheme that offered maximum benefits at reasonable cost called for a grounding bank with tuned neutral reactor at Ohio River, relays for ground faults and switching facilities near Trinity so the 36 kv loop could be operated normally

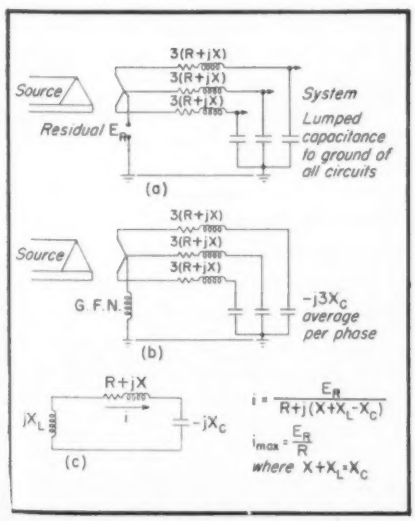


FIG 4—FUNDAMENTAL circuit shows how a ground fault neutralizer is tuned using residual current

closed but automatically sectionalized under fault conditions.

The initial grounding equipment was three 100 kva single-phase distribution transformers connected wye with the neutral grounded through a 150-kva 36-2.4 kv transformer with its secondary short circuited. This was replaced later with a grounding bank of three 150 kva transformer units and served until a zig-zag grounding transformer of proper characteristics was installed. This arrangement cut tripouts 70%.

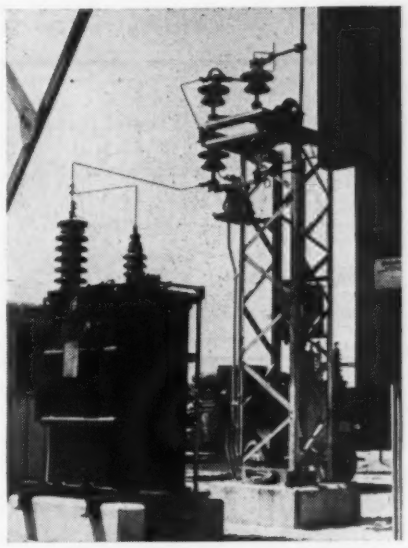
Eventual system load increases and voltage regulation problems on parts of the 36-kv loop led to a new 69/36-kv substation at Oakland City. The loop was sectionalized at Lynnville and Ft Branch as shown in the layout of the present system, Fig 2. At this point two 40-amp ground fault neutralizers were installed.

These new ground fault neutralizers were designed to operate over a range from 10 to 40 amp. Each has 25 kv insulation and can carry 100% current for each of 25 tap positions for 10 minutes or 30% of these currents continuously. Reactance ohms and maximum current versus tap position is shown accordingly in Fig 3.

Before it can be put in service a neutralizer must be tuned to the system. When this is done, the neutralizer gives practically zero current through a single phase-to-ground flashover. Thus the fault is self clearing. There are two ways to select the correct "in tune" tap positions. The most obvious is to ground one phase and measure the ground current for each tap position until the one is found that gives minimum ground current. But there is an easier test under normal conditions.

With the transformer neutral free, there is a small voltage between neutral and ground (system ungrounded) due to unequal capacitance to ground of the three phases. When the neutralizer is connected this small voltage causes current to flow through the neutralizer. When neutralizer ohms are made equal to the distributed capacitive ohms to ground of the three phases of all circuits, the neutralizer is in tune.

This condition is shown in the simple circuits of Fig 4. Fig 4-a shows the residual voltage E_R. Fig 4-b shows the neutralizer connected. But



GROUND FAULT neutralizer installation. Switches in center are by-pass switches for the neutralizer

in this case E_R is not shown. It does not appear at any one place since it is forcing current to circulate through the neutralizer and the three phases of the system through distributed capacitance to ground. Fig 4-c shows what takes place. The current "i" depends on the tap setting of the neutralizer. It is a maximum when capacitance reactance and total inductive reactance are equal, thereby leaving only resistance in the circuit. When neutralizer ohms are too high or too low the current "i" will be less

TABLE II—System Performance

	Tripouts per 100 Miles Of Line per Year		
	Lightning	Other Causes	Total
(a) Neutral Ungrounded (Avg of 3 yrs)	49	20	69
(b) Neutral Grounded with Temporary Reactor (Avg of 5 yrs)	40	8	48
(c) Neutral Grounded with Ground Fault Neutralizer (Avg of 1 yr)	38	6	44

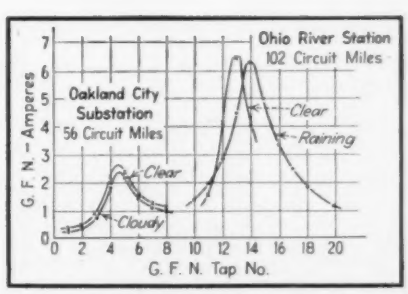


FIG 5—TUNING TEST results show optimum tap positions for two ground fault neutralizer locations

Oscillograms For Staged Line-to-Ground Arcing Faults For The 56 Miles Of Circuit

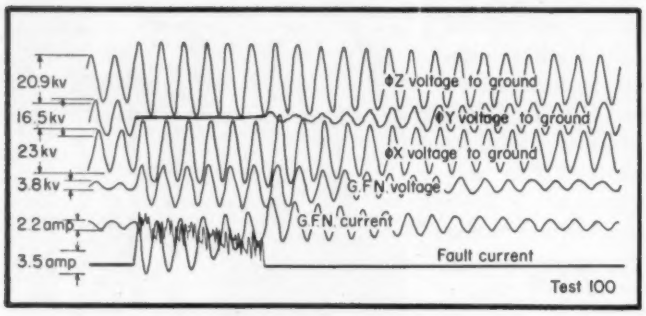


FIG 6 (a)—NEUTRALIZER in tune—1631 ohms

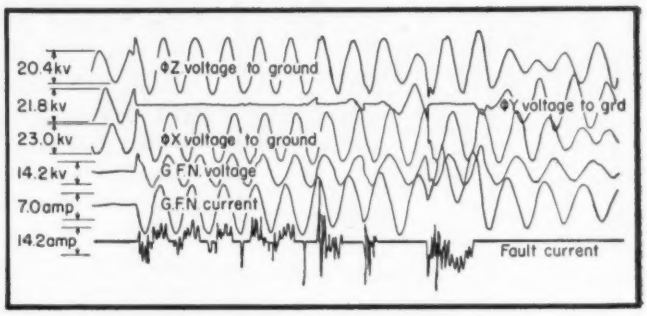


FIG 6 (b)—NEUTRALIZER out of tune—2520 ohms

than maximum. To find the "in tune" neutralizer tap, then, a current versus tap position test is made and the tap giving the highest current is the desired one.

Tuning Tests

Results of tuning tests on the Indiana neutralizers are shown in Fig. 5. The optimum tap position on the Ohio River neutralizer varied one tap due, apparently, to weather conditions affecting the capacitance. The amount of current varied too for the different tests on the two neutralizers. When all factors are considered, the optimum tap position may be expected to change by several taps. The curves are typical in that they show the variation of current with tap position for no-fault condition.

Fig 5 shows that the Ohio River neutralizer serves 102 miles of circuit and that maximum "in tune" current occurred on tap 13 and was 6.5 amp. This tap has a 10 minute current rating of 24.3 amp and a continuous rating of 7.3 amp. Thus current should not exceed 7.3 amp during normal operation and the by-pass switch relay should be set accordingly.

Residual voltage for the Ohio river station, with 102 miles of circuit, was found to be 290 volts or 1.2 percent of line to ground voltage. This voltage caused 6.5 amp to flow through neutralizer tap 13. Thus the residual resistance (R in Fig 4) had an unexpected low value of about 44 ohms. Tap 13 has 930 ohms. With a current of 6.4 amp this displaces the system neutral 6,045 volts continuously. Obviously, therefore, the higher the continuous current through the neutralizer, the greater will be the neutral displacement. Continuous current and neutral displacement, of course, can be reduced by reducing residual voltages. Complete transposition of all circuits, balancing shunt capacitors or both, will be effective. Continuous current can also be reduced by operating the neutralizer one or two taps from "in tune" tap.

Staged Faults

Oscillographic measurements were made for 14 staged line-to-ground arcing faults on the Oakland City substation neutralizer for circuit lengths of 56 and 158 miles. The neutralizer cleared each fault for all tap positions tested. A summary of the 14 tests is given in Table I.

Optimum tap position for 56 miles was No. 5 (1631 ohms). Tests were made on optimum tap position and with taps as high as No. 11 and as low as No. 1.

For 158 miles, optimum tap position was No. 23 (565 ohms). Tests again were made at optimum tap; as high as No. 25 and as low as No. 19.

Table I shows that the first three tests were made with 9.5 in. gap; approximately the air distance in the flashover of a 36-kv insulator. Arcs for this spacing were cleared with so little flash and slight noise that the gap was reduced to 4.1 in. to represent a condition of interference as when a tree blows close to the line and cuts clearance below that of porcelain insulation on the line itself.

Records show that in almost all 14 staged tests, current through the neutralizer and fault was offset by a relatively large d-c component. This was caused by the sudden change in the flux in the magnetic circuit of the neutralizer and is a variable depending on the instantanous value of the voltage across the neutralizer at the instant the fault appears. The d-c currents were present in the neutralizer and in the fault.

Fault current in every test was a very ragged trace consisting of what

Oscillograms For Staged Line-to-ground Arcing Faults Of 158 Miles Of Circuit

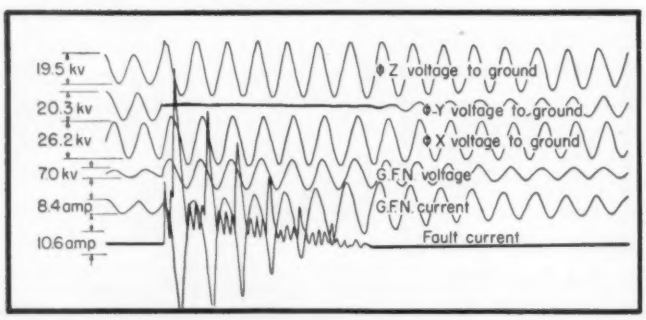


FIG 7 (a)—NEUTRALIZER in tune—565 ohms

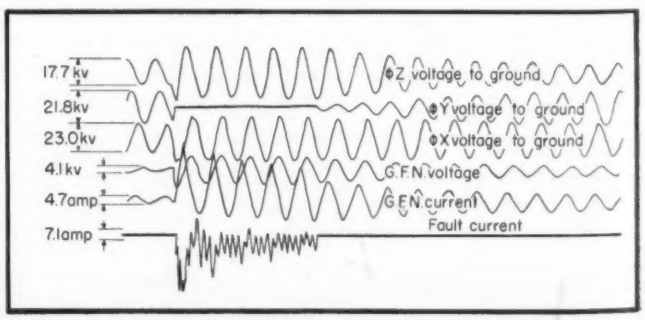


FIG 7 (b)—NEUTRALIZER out of tune—618 ohms

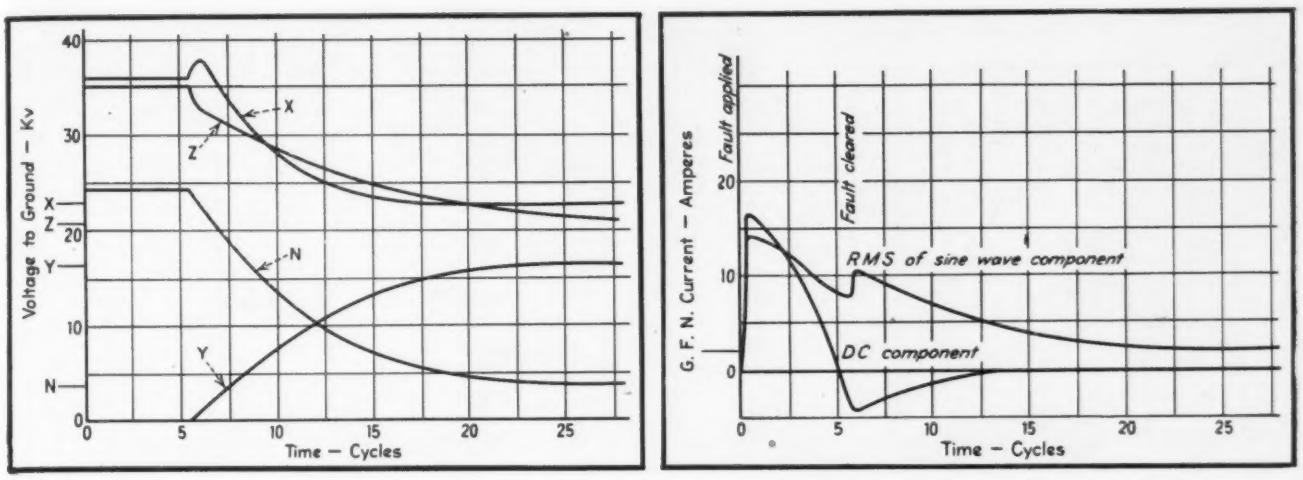


FIG 8—VOLTAGE AND CURRENT for Oakland City neutralizer installation before, during and after a line to ground arcing fault

appears to be the fundamental 60-cycle frequency with the third, fifth and seventh harmonics. These frequencies were superimposed on the d-c component. In almost all tests whether the neutralizer was in tune or not the fault cleared after the d-c component of current had disappeared. This is illustrated in Fig 6a, 7a and 7b.

Since the fault current contains such large harmonic components it is difficult if not impossible to determine when the neutralizer is on the optimum tap position from the fault current magnitude. The frequency of the current in the neutralizer after the fault cleared, however, gives a very good check. When this frequency is more or less than 60 cycles the neutralizer is not in tune. The optimum tap position obtained in this manner checks with that obtained from tuning tests with no fault on the system. For Fig 6a the current decreased at a frequency of 60 cycles whereas for Fig 6b it decreased at 51 cycles.

In each test for "in tune" conditions, the Y phase-to-ground voltage was the least. This indicates that the neutral of the system was shifted toward the Y corner of the delta. When the fault was applied, the voltage of the faulted phase dropped to zero above ground and the other two phases increased to values near line-to-line voltage. This is shown in curve form in Fig 8 for the "in tune" test on the 56-mile circuit with an arcing line-to-ground fault. (Fig 6a). No records were taken of the line-to-line voltage as these remained practically constant.

There were no transient over-voltages in evidence on any of the oscillographic records. No trouble was had from displacement of phase voltage to ground during tests. No voltage troubles were expected because the system lines and equipment were rated for full neutral displacement operation during fault conditions.

Experience

Table II shows performance of the 36-kv system with the neutral (a) ungrounded, (b) grounded through the temporary reactor and (c) grounded through the ground fault neutralizer. It will be noticed that lightning tripouts were reduced roughly 20 percent. This reduction is not large because most tripouts due to lightning on wood pole lines without overhead ground wires or ground wires down the pole are caused by line-to-line faults and the only improvement that a tuned neutral reactor can provide is to prevent line-to-ground faults from becoming line-to-line faults.

Line tripouts due to "other causes" including wind, interference, unknown, were reduced more than 50 percent since many of the faults ordinarily start as single line-to-ground faults. Probably some of the reduction in line tripouts could be traced to improvement in tree trimming and other ground clearance improvements.

Reduction in damage to station equipment during single line-to-ground faults has also been achieved since adoption of the tuned neutral reactance method of system grounding.

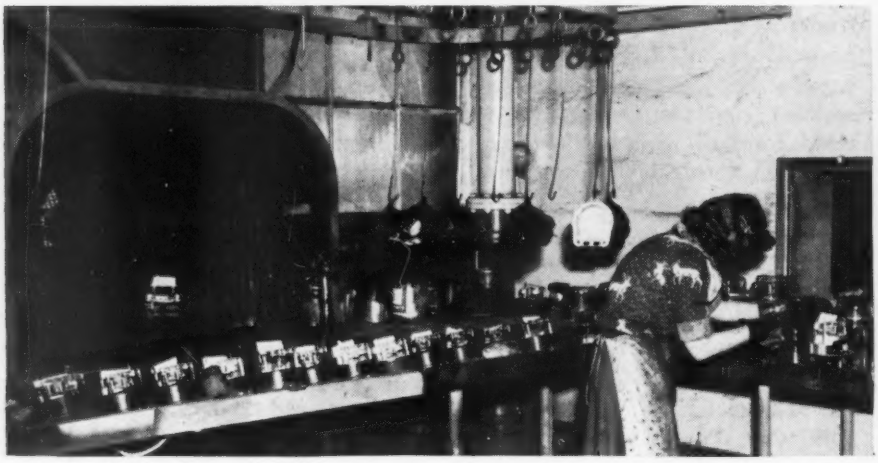
After initial tuning tests it was found that the Ohio River neutralizer was sometimes loaded beyond its continuous current rating when in tune because of the residual voltage of about 290 volts and the low effective resistance of ground current circuit. Solution to this was to operate the neutralizer one or two taps from optimum tuning or just enough to prevent the system from drifting into optimum tuning with varying weather conditions.

Residual voltage tests on each of the four connected lines showed that lower residual voltage than 290 volts could be obtained with more effectively spaced transposition; these will be provided as lines are rehabilitated. It was also calculated that changes in phase positions on the two Mt Vernon lines would materially reduce residual voltage at Ohio River for normal operation. In fact it was found that when phase positions were changed on these two lines by reconnecting at the terminal substations, the residual voltage for the connected system at Ohio River was reduced to about 10 percent of its former value.

Changes in system capacitance caused by weather and seasonal foliage changes were observed to some extent. For 102 miles of line these change amounted to no more than about 6 percent of normal capacitive reactance during dry weather and the observed variation was equivalent to about one tap on the ground fault neutralizer. By selecting the proper tap, the system will bring itself into optimum tune shortly after a rain starts falling and at a time when lightning usually becomes most frequent.

1 **METERS FOR TEST** arriving in cartons with their records in an attached envelope. They will be unpacked, sorted and grouped with others of the same make, type and size. Record cards go through the window (right) to the office to await test data

2 **TEST TICKET** being written up. The meter has been unsealed and cover removed. This ticket will accompany the meter through the shop and carry a record of all operations. Meter goes from here through opening to the "as-found" test board



5 **PAINTING AND TOUCH-UP** is done in this completely-enclosed room. Buffing and spray painting is done under the exhaust hood at left. Note the turntable in the center of the hood and the blank covers put over the meter mechanism during spraying

6 **MINOR REPAIRS** are done here on three double benches. Meters are fitted with new or reconditioned registers

Meters Shop-Tested And Reconditioned In 33 Minutes

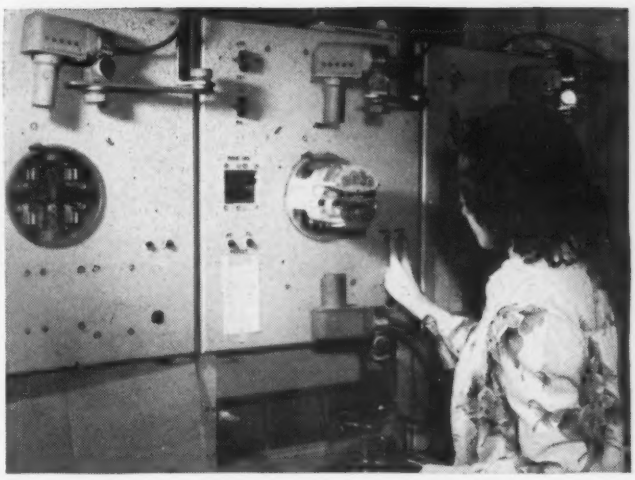
Electrical World pays a camera call on a completely-mechanized shop for testing single-phase watthour meters

ONE OF the most thoroughly mechanized, factory-type shop testing systems for single-phase watt-hour meters in the country is at Pennsylvania Power and Light Co's operating center, Hazelton, Pa. Here, in pictures, is ELECTRICAL WORLD'S report of a visit to this unusual meter shop.

About half of the company's 500,000 single phase meters are on a shop testing schedule. The remainder are tested on the customers' premises.

At present the new Hazleton shop is staffed to handle 160 removed meters and 75 new meters a day, or approximately 60,000 meters a year. This rate can be substantially increased without installing additional equipment by increasing the present force of 3 men and 14 girls.

Girls who do production testing are all under 25 years of age. They are graded by skills into four groups: Calibrator, Assembler First Class, Second Class and Third Class grades, in descending order. Nature and sequence of testing and maintenance operations performed by the present shop force, the time required for each task and job classification is given in



3 **"AS-FOUND" TEST** being made on special automatic board that performs light-load, full-load and 50 percent power factor tests automatically and in sequence. Operator merely sets dials for voltage and make of meter, checks accuracy directly

4 **COVERS BEING CLEANED** and gaskets replaced after the meter has passed its as-found and high potential test but before it goes to the paint room. Meters to be converted to socket types are diverted ahead of this station

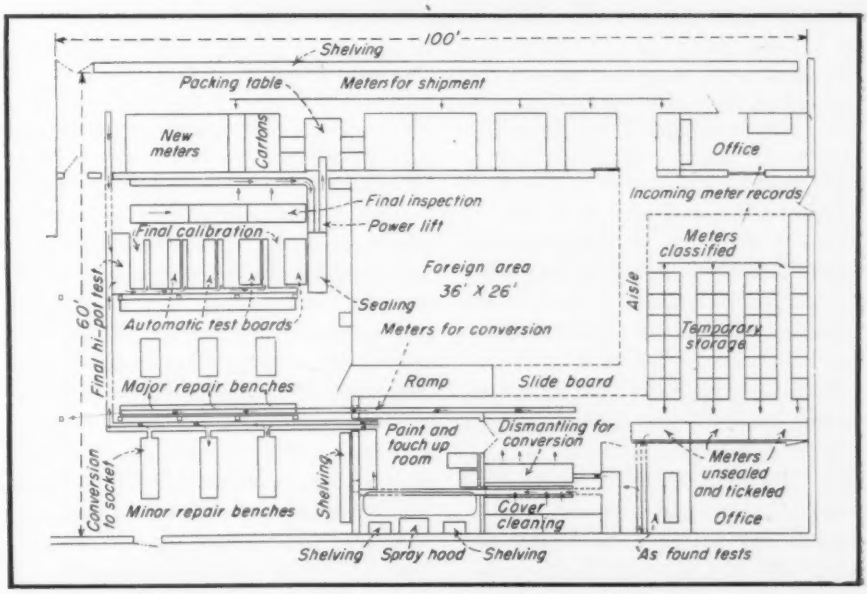
7 **REPAIR RACKS** can be tilted 45 deg or held vertical. The seven meters on each rack hang on swinging gates

8 **MAJOR REPAIRS** are done on three benches at the right. In the background are four, four-position automatic test boards where meters get final calibration test. Flow of meters is along the slide boards at the right of the test boards

the accompanying production flow chart. Examination of job operating time shows that it takes an aggregate of 32.5 minutes to complete the work on a meter from the time it enters the shop till it is ready for shipment.

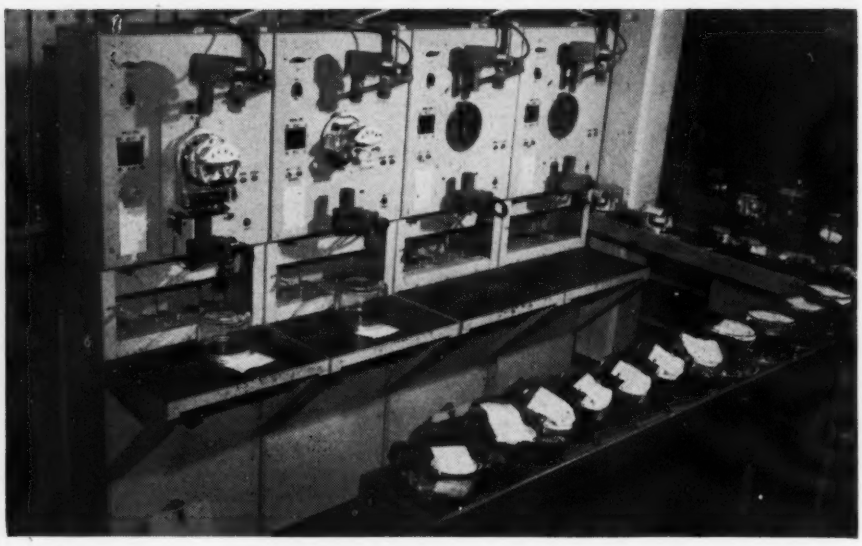
Use of girls for such maintenance and calibration work has been entirely satisfactory to date. Skill and technical knowledge required in the various operations has been reduced to simple tasks by the design of special tools and automatic devices.

Prominent among these is a completely automatic, photo-electric meter calibration board that performs light-load, full-load and 50% power factor tests on any meter automatically and in sequence, once the board has been set up for the particular meter. To make the operation even simpler, ro-

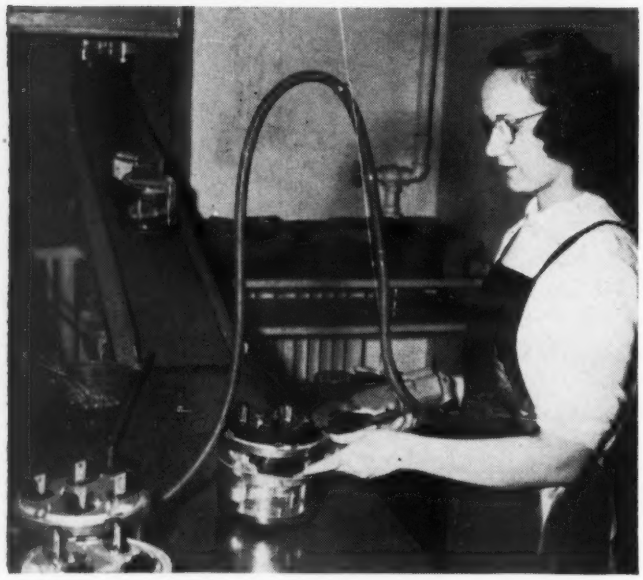


SHOP LAYOUT for periodic testing of single phase watthour meters. Floor area devoted to the operation is 3,785 sq ft

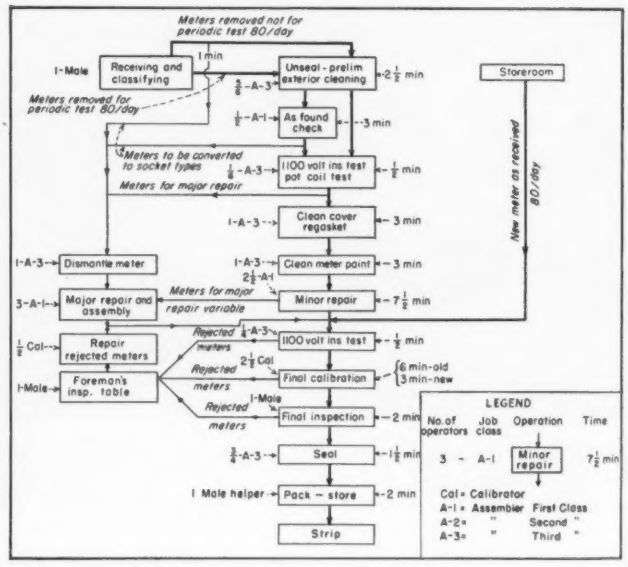
9 FINAL Hi-POT TEST at 1,100-v is made here on all meters, before they go to the calibration test. New meters enter the production line at this point



10 AUTOMATIC TEST BOARDS where meters get their final calibration test are similar to those used for "as-found" test. Standards, calibrated in percent accuracy are in a recess at the bottom of the panel. They are lighted by a hidden fluorescent lamp and gang-reset by a mechanical lever. House as well as socket types can be tested



11 METER SEALS are being crimped here with a pneumatic rivet squeezer like those used in aircraft work. The meter is sealed after passing final calibration test and visual inspection. Power conveyor in the background leads to the packing room



FLOW DIAGRAM shows sequence of operation performed on single-phase-meters, returned to the shop for periodic test and/or conversion from house to socket type. Time in minutes for each operation and the grade of operator skill required is shown

tating standards for each of the three tests have been calibrated in percent accuracy so that it is only necessary to note and record the readings when the cycle is completed and make the necessary adjustments if the meter is "off."

Meters are conveyed from one operating station to the next on waxed, hardwood, troughs or "slide boards" along which they can be skidded easily. Power conveyors were considered but rejected as being too costly and requiring too close timing of operations. Only one power conveyor is used; to carry meters from final sealing bench to packing room.

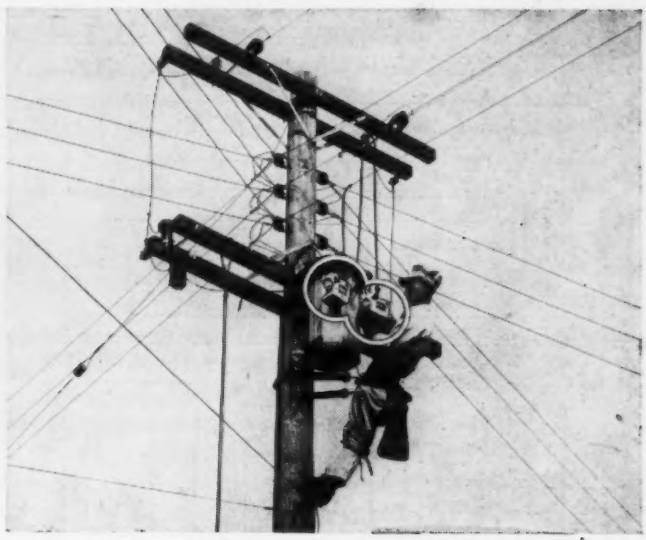
Labor turnover averages about 15% per year. It is about the only problem involved in the use of girls for this type of work. The most common reason for ending employment is marriage, although there are some cases in which employees feel themselves unsuited for the work.

Employment aptitude tests establish an applicant's ability to do the work required, and advance through the three "assembler" grades to "calibrator"—the highest attainable.

In addition to the maintenance and testing of single-phase meters returned to the shop at 96 month intervals, all single-phase meters removed from service for any other reason, are put through the production lines for maintenance and test. This latter group includes house-type meters for conversion to socket types.

About 3,200 house-type meters are returned to the shop each month. Of these about 2,500 must be returned to service to supply the system demand for house-type meters. The remainder or 700 meters a month are converted to socket type in the production line. This operation is not shown in the accompanying pictures, however.

TEST METERS of the type used on the transformer loading survey are loaded ready for a day's installation in the field



INSTALLING METERS on distribution transformer secondary leads. One meter is installed on each transformer secondary

Transformer Survey Seeks Better Loading

ROBERT C. STEVENSON, JR
System Planning Engineer
Electric Power Board
Chattanooga, Tenn

ABOUT A YEAR AGO, a distribution transformer load survey program was started on the Chattanooga system. Its primary purpose was to locate and replace over-loaded transformers before they could fail or become damaged. Next most important aim was to improve the transformer loading factor by replacing under-loaded and over-loaded transformers.

Ultimately the most desirable condition will obtain when peak load on each transformer falls between rated load and maximum allowable overload. Of course this is impractical. But when we consider that installed distribution transformer capacity represents an investment of about $12 per kva, it becomes obvious that even a small improvement in loading factor will result in a substantial saving.

Additional Benefits

There are other benefits to be derived from such a survey. The patrolling of primary and secondary circuits, during the survey, keeps maps and records up to date, locates potential cases of trouble and prompts repair before trouble develops. The result is reduced cost of repairs and damage to equipment. But the end result of this and the replacement of overloaded transformers is improved service to customers.

Our distribution transformer load study is now in its second season. We begin it in October and continue it through March. One season's experience is not sufficient for definite conclusions. But it has indicated certain trends that we feel are significant and will be verified by future experience.

Last year, load was measured on 1,025 transformers supplying residential customers in seven areas typical of moderate income groups. A breakdown shows that 27% of these transformers were loaded between 0 and 100%; 36% between 100 and 150%, and 27% above 150%.

Ninety-seven of the transformers carried under 25% rate load. Some of these were removed and relocated, resulting in an improved loading factor.

We also found that 279 transformers were loaded above 150% rating and 63 of them carried 200% or more of rating. Heaviest loaded transformer was a 3 kva with a load of 9.6 kva or 320%.

If half of the transformers carrying 200% or more of rated load had failed last winter, some 30 transformers would have been involved. Even in times of normal transformer deliveries this wouldn't be pleasant to contemplate. Today, it would be serious.

While the load was being measured on these 1,025 distribution transformers, a total of 341 conditions were located that were potential sources of trouble. A classification follows:

CLASSIFICATION	CASES
Two or more customers on one meter	54
Secondary and service trouble	132
Arrester or cutout trouble	89
Transformer trouble	27
Primary or pole trouble	39
Total	341

The desirability of locating and eliminating these potential cases of trouble before the trouble occurred has already been pointed out.

Cost of Survey

Cost figures for the survey can be based only on one season's experience. However, except for variations in labor and transportation the cost is fixed. It appears that $2.00 per transformer tested is sufficiently accurate for estimating purposes. This

* Based on a paper by the author presented before East Tennessee Division Power Distributors Association, November 21, 1947.

DISTRIBUTION TRANSFORMER FIELD TEST REPORT

Area North Chattanooga St. Address Boylston St. near Elinor St. Pole No. #-7011

KVA 15 Voltage 2400-120/240 Mfg. Westg. Serial No. 1407363 Co. No. 3509

TEST DATA

Date Installed	Type Meter	* Right Leg Read	Mult	Amps	KVA	* Left Leg Read	Mult	Amps	KVA	TOTAL KVA	% Rating	Seasonal Multiplier	Projected KVA Demand	Maximum % Rating	No. of Services 3-W	2-W	3¢	H.H.
10/24/47	M	5.9	20	118	14.2	5.2	20	104	12.5	26.7	178	1.17	31.2	208	15	1		

* Facing Transformer Secondary

THREE-PHASE TRANSFORMER BANKS—SECONDARY CONNECTIONS

Closed Delta

Transformer Co.No. Size ** Pcs.

Reading Reading

Mult Amps KVA % Rating

** Right-Middle-Left Facing Transformer

Open Delta

Transformer Co.No. Size ** Pcs.

Reading Reading

Mult Amps KVA % Rating

Secondary Bushings

REMARKS: Section good - No building lots available - Not much prospects for load growth.

One 3 wire service twisted in trees off transformer pole.

FIG 1—TEST REPORTS for each transformer are made on forms like this one

includes labor, transportation and the cost of the meters amortized over a 10 yr period.

Our survey has just begun. Last winter, as already stated, we tested 1,025 transformers. This and future winters we expect to test about 1,500 transformers a season. At this rate, each 2.4-kv distribution transformer on our system will be tested every 3½ to 4 yr.

For the tests we use a thermal-type demand meter and a split-core current transformer which are in one weather proof unit. The unit is light enough to hang on the secondary leads of the smallest transformer without any other type of support.

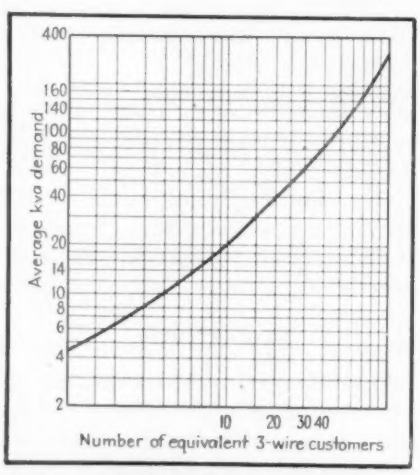


FIG 2—DIVERSIFIED DEMAND for any number of 3-wire residential customers is given by this curve which represents experience in seven substation areas

The split core current transformer can be connected for ratios from 8/1 to 100/1. The meter has a 6-amp full-scale deflection and is suitable for measuring loads from 0 to 72 kva at 120 v.

A student engineer and lineman composes the survey crew. A coupe is used for transportation because the large trunk provides ample space for hauling meters with least abuse.

One meter is installed on each transformer secondary leg in order to measure any unbalance that might exist. They remain in place for 24 hr and indicate the maximum 30 min demand that has occurred during this period.

After the meters are installed, a patrol is made of secondary mains and services connected to this transformer to detect trouble and to count the services. This data is recorded on the field test report form, Fig 1, showing the number of services in each class. Also reported is information on the location and identity of the transformer, data pertinent to transformer loading and the prospects of immediate load growth.

Meters are installed on 15 single-phase transformers each day. This requires 30 meters. Three phase banks are metered using one meter per transformer.

It takes about six hours to remove meters from 15 transformers and reinstall them. During the rest of the day the test crew reads area trend meters and completes reports for the transformers that have been tested.

Recommendations Based on Tests

Reports on transformer loading form the basis for recommendations for replacing overloaded or underloaded transformers. Transformers with a load of 150% of rating or more are replaced. New transformers are installed on a 100% load basis after taking into account any indicated load growth. Underloaded transformers are not replaced unless there is at least a difference of two sizes between the existing and the required rating. Transformers that have ratings of 5 kva or smaller are not replaced due to underload conditions.

Trend Meters Help

Annual peak load on distribution transformers on our system is in December, January and February. Thus if load is measured on peak, all transformers would have to be metered in these three months. Even if this was feasible, the peak would be missed on a good share of transformers. To overcome this, a method has been devised for approximating maximum load without measuring it on peak.

To do this, several transformers—about 1 per 100—that appear to be typical with respect to the number and class of services supplied are selected in each area. On these transformers conventional type kilowatt-hour meters with demand attachments are installed. These are called "trend meters". Transformers in a different area are used for this purpose each year.

Curve Plotting

Weekly demand and energy readings from trend meters are used to plot a curve giving the relationship between maximum demand and the demand at any other time during the year. Factors derived from this curve are applied to all readings taken on transformers in the area. In this way the transformer demands can be converted to an "equivalent maximum" basis and used in applying transformers.

For quite a few years we have

applied distribution transformers on a basis of the number of services connected. To determine the diversified demand represented by a given number of services we used a curve plotted from data obtained on the Tennessee Electric Power Company system and published in ELECTRICAL WORLD late in 1939.

Similar curves of average kva demand against number of three-wire services have been prepared from data obtained from our survey last winter. The curve, Fig 2, shows this relationship from the seven substation areas tested. Definite conclusions can't be reached from this limited information but a comparison of the two curves indicated that our diversity factor is lower than that given by the older curve. The old and new curves practically coincide up to five services but with 18 services the old curve would demand a 25-kva transformer while our curve would demand a 37½-kva transformer. Both are based on a transformer loading of about 100% rating.

This reduction in diversity can be attributed to increased residential usage and a greater saturation of major appliances.

Variations in the demand among different classes of three-wire services is fully recognized. To take this fact into account we have arbitrarily divided distribution areas into three groups which we call heavy, medium and lightly loaded areas. As the transformer load survey is completed in each area a curve is plotted for that area based on the average of all transformers tested, except those that supply house heating. These are treated as a special case.

The diversity curves for each area will be combined and resolved into a family of three curves which will be used for the future application of transformers.

The same rule will not apply to every distribution system. However, with our survey in medium areas as a basis it is indicated that a 5-kva transformer with as many as 3 three-wire services, a 7½-kva with 6, a 10-kva with 8, and a 15-kva with 12, a 25-kva with 20, or a 37½-kva with 30 probably has a peak of about 150% or more of rating.

A diversity test can be made by selecting several typical transformers on a system with as many or more than the number of services shown above and meter these transformers. Then plot a curve of the transformer kva demand against the equivalent number of three-wire services. The results may vary widely from those given here but this curve will, at least, serve as a starter and a basis for making an estimate.

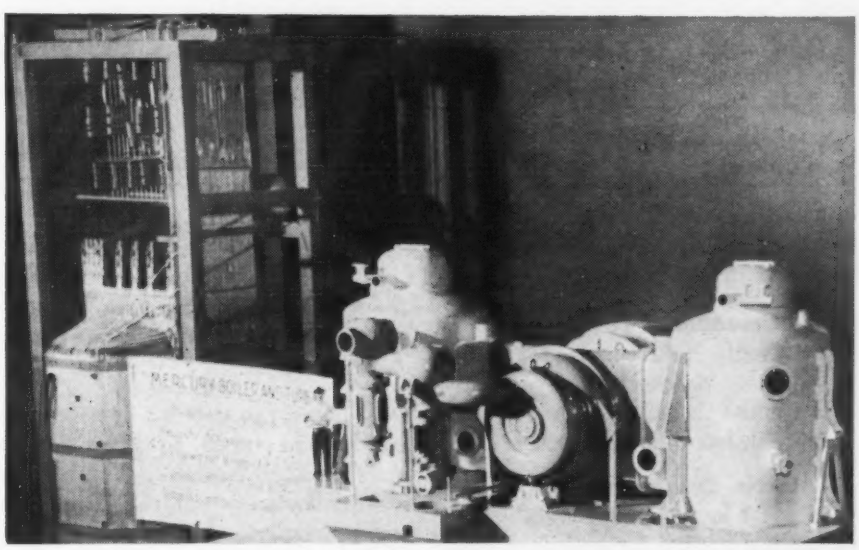
Five two-wire services are considered as equivalent to one three-wire service. This seems proper where two-wire services predominate but in heavy and medium areas where three-wire services predominate, the inclination is to consider the two-wire services as potential three-wire services and give them a little more weight. This policy can only result in the provision of a little more than 50% reserve capacity.

First Integrated Mercury Unit Takes Shape

E. L. RICHARDSON
General Electric Co
Schenectady, N. Y.

First of two 7,500-kw mercury boiler-turbine units is expected to begin operation this year for Public Service Co of New Hampshire at Portsmouth. Total initial installation will have two 7,500-kw, 1,200-rpm mercury turbines with individual condenser-boilers which supply 600-psi 825-F steam to a 25,000-kw 3,600-rpm steam turbine with hydrogen-cooled generator.

The steam turbine sits between the two mercury units. Normally, both mercury units feed the steam turbine, but the steam unit can operate at part load with either mercury unit out of service.



MODEL MERCURY BOILER and turbine generator and condenser boiler for 53,000 hp fuel burning plant of Public Service Company of New Hampshire

New mercury boilers are a step beyond Kearney, rebuilt in 1938, and a long measure ahead of Schenectady and Hartford units. Most of the heat transfer to mercury occurs in the vapor phase, following successful experience at Kearney. Boiler heat release is low compared to conventional steam practice. Both mechanical and electrical fly-ash collectors will be installed, the former to minimize fan erosion. Units are equipped to burn either oil or coal.

Mercury pressure below 150 psi represents no great change from Kearney, but higher steam conditions promise appreciably better over-all plant efficiency. Condenser-boilers work on a 30-F temperature differential which simplifies water-treatment problems.

Frequency Of Starting Of Room Coolers

J. W. ANDERSON*
Philadelphia Electric Co
Philadelphia, Pa

IT IS WELL KNOWN that compressor motors on room air conditioners must have high starting torque and therefore high locked-rotor current; that in at least some areas they are low revenue producers in relation to their demand on the system; and that it is therefore difficult to justify expenditures for voltage drop correction.

Industry discussions of permissible locked-rotor currents for room air conditioners have been hampered by lack of factual data on frequency of starting. It was recognized that permissible voltage drops and therefore permissible locked rotor currents were a function of frequency of occurrence.

An opportunity to secure information on the frequency of starting room coolers arose during the summer of 1947 when the Philadelphia Electric Co surveyed the starting frequency characteristics of 18 residential room coolers.

Data obtained from this group during an 11-week period is summarized in the article and appears to warrant several conclusions:

1—There seems to be some relation between the frequency of starting of room air conditioners and the sum of wet- and dry-bulb deg hrs.

2—The starting of bedroom units is more evenly distributed over hours of the day than starting of living room units, which seems to peak sharply in late afternoon hours.

3—Hourly distribution of all starts, during 24 hr, generally follows that of bedroom units because they were more numerous in the test group than living room units. Less than 10% of all starts occur in any one hour.

4—In general frequency of starting of room air conditioners is low. Most units start not more than three times a day, not oftener than once an hour.

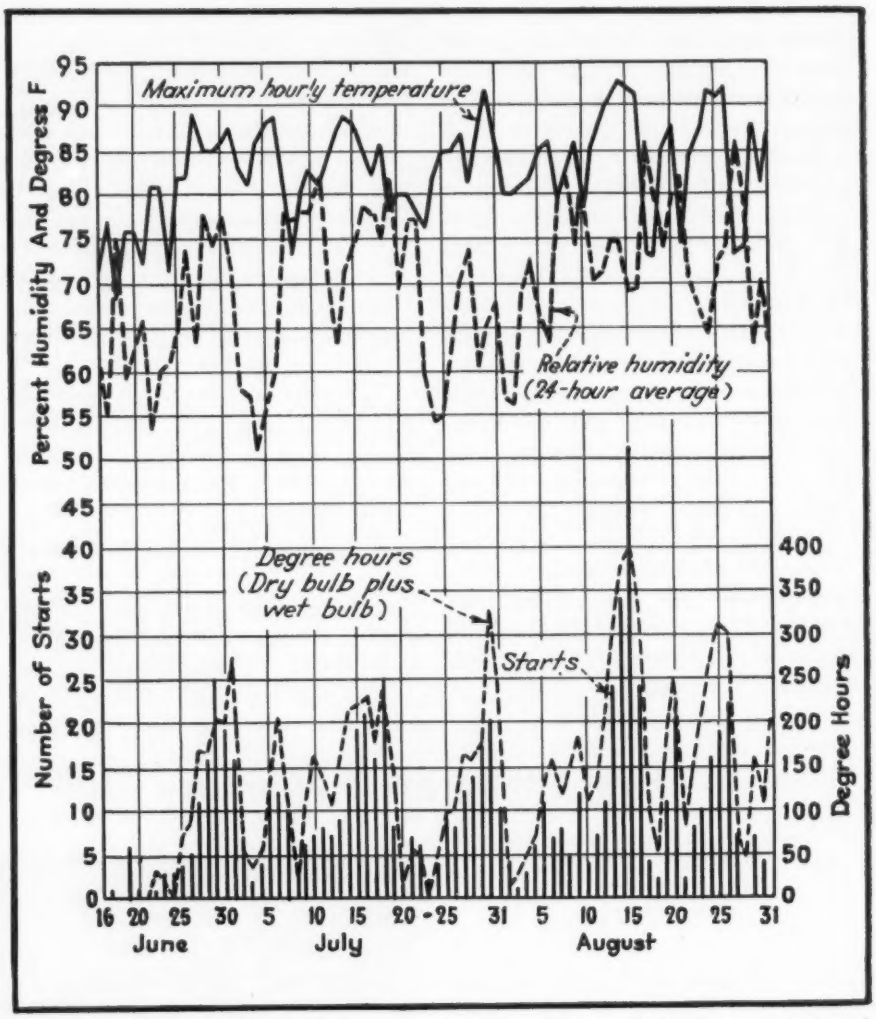


FIG 1—DAILY STARTS in relation to weather data. Note correlation between starts and daily degree-hours

5—Automatic control results in a sharp increase in the frequency of starting.

6—Utilities can expect a considerable increase in room air conditioning units on their systems; they will be mostly manually controlled and located in light-load density areas.

7—It is believed that understandings already reached between the electric utility and the air conditioning industries make it possible to supply adequate electric service for normal concentrations of these devices to be expected in the future.

8—Further data and experience is needed to confirm these conclusions.

The 18 installations surveyed in this study covered a wide range of neighborhood and economic status. All but one involved either a $\frac{1}{2}$-hp or a $\frac{3}{4}$-hp room cooler. The exception was a 3-hp unit used to cool several rooms in a large house and warrants separate consideration. Of the 17 fractional hp installations remaining, 13 were in bedrooms; four in living rooms.

During the survey 768 starts were accumulated by these 17 units in the 11 weeks beginning Monday June 16 and ending Sunday August 31, 1947. These starts are classified by customer, month and location in Table I. As might be expected the number of starts varied widely from one cus-

* Based on paper by author presented before Transmission & Distribution Committee of EEI, Chicago, May 3-4, 1948.

tomer to another, ranging from as low as 7 to as high as 102 per season for the bedroom units. One of the living-room units started 105 times.

No attempt was made to measure starting currents or starting voltage drops. Nor has this study included separate use of the fan. Starts referred to herein are for compressor motors only.

There also was considerable variation in the duration of runs. They ranged from a few minutes to several days. The longest was over 96 hours. Several were in excess of 30 hrs.

Duration of run has an important bearing on frequency of starting. Long running hours, in general, mean fewer starts. Running hours for each unit, as scaled from graphic charts, are given in Table I. To indicate day and night operations, running hours have been divided into those occurring between 6 AM and 6 PM and those between 6 PM and 6 AM EST.

The 17 units studied ran nearly 4,000 hr during the 77 days ranging in individual cases from 56 hr to 578 hr. Some bedroom units operate primarily in daytime, others primarily at night. The same situation exists for living-room units. However, total hours of operation are almost equally divided between day and night for both living room and bedroom units.

The number of starts per day is influenced by several factors, such as the vacation or week-end schedules of customers; whether the customer chooses manual or automatic control for that day. But overall, the number of starts of a group of users appears to be a function of temperature and humidity conditions that make for bodily discomfort.

Maximum hourly temperature per day is plotted on the upper part of Fig 1 along with 24 hr average relative humidity. The correlation between these plots and the number of starts is scarcely adequate. Much better correlation is obtained with the plot of daily deg hr on the lower part of Fig 1. Degree-hours are the sum of dry and wet-bulb deg hr using 75 deg F base for dry-bulb and 65 deg F for wet-bulb.

Shape of the deg-hr plot is similar to that of the bar chart of starts. While the correlation is not perfect, it seems significant. Of course, with the small number of units involved, the absence of one customer over a week-end, or his use of automatic control for a short time can destroy the correlation for that day. But such incidents lose their importance over long periods as experience accumulates. For example, the monthly totals of starts per 100 deg-hr for July and August were only 11% apart and, of course, their variation from the 2-month average was only half this value as shown by the following:

	Number of starts	Degree hours	Starts per 100 deg hrs	Relative	
July	314	4143	7.58	111	106.
August	355	5204	6.82	100	95.4
2 months ..	669	9347	7.15	106	100.0

Thus there seems to be a correlation between starts and deg-hrs. Accumulation of additional data might lead to sufficiently accurate correlation factors for various parts of the country that in combination with other basic data, would lead to a method of predicting starting frequency for groups of room coolers from available weather bureau data.

Hourly distribution of starts throughout the day is given in Table II and on a percentage basis. Undoubtedly the percentage data is the more significant. They show that bedroom units may be started any hour of day or night. But only one hour—4 to 5 PM EST contains as many as 8% of the total. Percentage distribution of bedroom unit starts is considerably flatter over the day than living-room starts which peak sharply between 3 and 6 PM. Each of these three hours contain more than 12% of total living-room starts and combined they produce more than 38% of the total.

Nearly 25% of all starts occurred between 6 and 11 PM or during the evening lighting period. It is questionable whether this lighting period now has much more significance than other period of the day. Modern curtained residential interiors are dark enough to require artificial lighting for comfortable reading or working even in daylight. Under such conditions daytime voltage flickers assume increasing importance.

Daily starts for the entire 11 weeks is summarized in Table III. Significance of this table lies in the data on maximum starting frequency for individual units for the day and for the hour of the day. Table IV shows that on 59 of the 77 test days no unit started more than three times per day; that on 69 test days, no unit started more than once an hour. However, units on automatic control ran as high as 38 starts per day and five starts per hr for as many as three consecutive hours. Highest daily starting rates occurred on August 13, 14, 15, 16, 20 and 31. Unit A was responsible for eight starts on August 13, Unit O for 19, 38 and

TABLE I—Summary Of Starts And Running Hours

Unit	Number Of Starts: June 16–30	July 1–31	August 1–31	Total	Running Time (2½ Mo.) Hr and Min: 6AM–6PM Est	6PM–6AM Est	Total	Avg Hr Per Start
BED ROOM 13 UNITS								
A	1	31	39	71	70–05	21–40	91–45	1–17
B	4	9	13	26	158–40	215–15	373–55	14–23
C	4	9	10	23	91–40	253–40	345–20	15–01
D	5	13	6	24	93–35	137–30	231–05	9–38
E	14	54	15	83	71–45	161–30	233–15	2–49
F	14	29	59	102	87–25	126–00	213–25	2–05
G	3	4	8	15	71–05	28–15	99–20	6–37
H	4	10	8	22	16–20	56–20	72–40	3–18
I	12	14	17	43	132–20	63–40	196–00	4–34
J	8	37	30	75	518–35	59–55	578–30	7–43
K	5	15	14	34	114–00	215–25	329–25	9–41
L	0	0	7	7	13–45	42–55	56–40	8–05
M	10	29	7	46	130–30	274–05	404–35	8–48
Total	84	254	233	571	1569–45	1656–10	3225–55	5–39
LIVING ROOM 4 UNITS								
N	5	18	11	34	43–00	76–25	119–25	3–31
O	7	22	76	105	185–35	196–55	382–30	3–38
P	3	17	23	43	46–40	62–00	108–40	2–32
Q	0	3	12	15	81–00	19–15	100–15	6–41
Total	15	60	122	197	356–15	354–35	710–50	3–36
TOTAL 17 UNITS								
Total	99	314	355	768	1926–00	2010–45	3936–45	5–08

TABLE II—Hourly Distribution Of Starts

Hour Of Day EST	Number Of Starts Bed Room	Living Room	Total	Percent Of Total Bed Room	Living Room	Total
MN-1AM	9	2	11	1.58	1.02	1.43
1-2	6	0	6	1.05	.00	.78
2-3	5	0	5	.88	.00	.65
3-4	10	0	10	1.75	.00	1.30
4-5	3	1	4	.53	.51	.52
5-6	13	1	14	2.28	.51	1.82
6-7	11	3	14	1.93	1.52	1.82
7-8	28	4	32	4.90	2.03	4.17
8-9	32	2	34	5.61	1.01	4.43
9-10	33	4	37	5.78	2.03	4.82
10-11	17	7	24	2.98	3.55	3.12
11-N	27	9	36	4.73	4.57	4.69
N-1PM	32	13	45	5.61	6.60	5.86
1-2	35	12	47	6.12	6.09	6.12
2-3	35	17	52	6.12	8.63	6.77
3-4	35	24	59	6.12	12.18	7.68
4-5	47	25	72	8.23	12.69	9.38
5-6	38	27	65	6.65	13.71	8.46
6-7	32	16	48	5.61	8.12	6.25
7-8	26	13	39	4.55	6.60	5.08
8-9	28	8	36	4.90	4.06	4.69
9-10	25	9	34	4.38	4.57	4.43
10-11	32	0	32	5.61	.00	4.17
11-MN	12	0	12	2.10	.00	1.56
Total	571	197	768	100	100	100

8 starts on August 14, 15 and 16 respectively, Unit F for 12 and 9 starts on August 20 and 31, respectively. Units O and F were definitely known to be on automatic operation whereas automatic operation of Unit A is suspected although the customer claimed manual operation only. Table I shows that Units O and F had 105 and 102 starts for the season, totals that are considerably greater than those for other units.

Further illustration of the effect of automatic control on frequency of starting was obtained from the 3-hp air conditioner (Unit R). Data on this unit have not been included with room coolers because of its different class. During August this unit started 143 times in running 27 hours and 50 minutes during 16 days of the month. The greatest number of daily starts was 17 (16 each on two other days). The greatest number of hourly starts was three, occurring 20 times during the month.

Fortunately all these automatic units were favorably located as to transformer and secondary copper size.

To illustrate what might happen if two automatically-controlled units are supplied by the same transformer secondary combination, the hourly starts of Units O and R were combined statistically for August 14, 15 and 16. These two units produced daily total starts of 35, 54 and 25 with 8 starts per hr occurring on two occasions and 7 starts per hr five times. Of the 54 combined starts (on August 15) 29 or nearly 54% occurred between 2 PM and 6 PM.

Evidently then, one automatically controlled unit on a single secondary could cause serious flicker. The possibility of trouble multiplies rapidly as the number of such units is increased.

Fortunately most room coolers have manual control only, or have been operated under manual control most of the time. Average starting frequency is low, as shown by the following data:

	Total	Number of Starts Per room cooler per day
June	99	0.388
July	314	0.595
August	355	0.674
July and August	669	0.635
June, July, and August	768	0.587

These low starting frequencies no doubt explain the lack of flicker trouble so far. However, present experience is based on low saturation. If additional room coolers are connected to the distribution systems so that several appear on the same secondary, the effect will be to increase the number of starts and therefore the number of flickers on that sec-

(*Continued on page* 133)

TABLE IV—Number Of Days Having Various Maximum Starting Frequencies

Max. No. Of Starts For Any Unit	Number Of Days For The Day	For Any Hour
0	3	3
1	18	66
2	19	4
3	19	2
4	6	....
5	4	2
6	2	....
8	2	....
9	1	....
12	1	....
19	1	....
38	1	....
Total	77	77

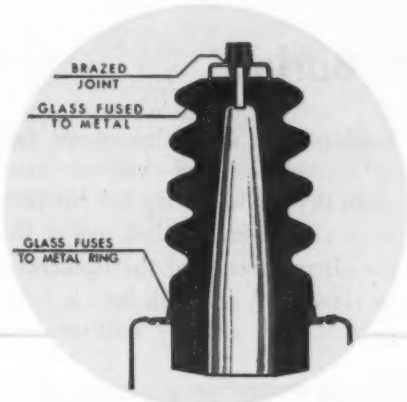
TABLE III—Total Number Of Daily Starts And Daily Maximum Frequency Of Starting

		NUMBER OF STARTS																												
		DAY OF THE MONTH																												
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
		JUNE																												
Bed Room	(13 Units)																4	1	0	6	1	0	0	3	2	3	4	9	14	21	16	
Living Room	(4 Units)																0	0	0	0	0	0	1	0	1	1	1	2	2	4	3	
Total	(17 Units)																4	1	0	6	1	0	1	3	3	4	5	11	16	25	19	
Max. No. Of Starts	For The Day																2	1	0	4	1	0	1	1	2	1	1	3	4	5	3	
For Any Unit	For Any Hour																1	1	0	3	1	0	1	1	1	1	1	1	1	1	1	
		JULY																												
Bed Room		12	6	2	3	9	10	9	4	4	6	7	6	8	11	16	16	13	19	6	2	6	6	2	2	5	7	10	11	13	16	7
Living Room		4	1	0	1	3	2	1	0	2	1	1	1	1	2	3	5	3	5	2	0	1	0	0	2	2	1	2	3	4	4	3
Total		16	7	2	4	12	12	10	4	6	7	8	7	9	13	19	21	16	24	8	2	7	6	2	4	7	8	12	14	17	20	10
Max. No. Of Start	For The Day	2	4	1	2	2	3	2	2	2	3	3	3	2	4	5	6	3	3	2	1	2	2	1	1	2	3	2	3	3	3	2
For Any Unit	For Any Hour	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1
		AUGUST																												
Bed Room		3	1	2	2	9	4	6	3	10	2	5	8	16	11	10	13	2	2	11	19	2	7	10	13	17	18	6	0	6	4	11
Living Room		1	0	1	4	2	3	2	2	2	2	2	3	8	23	41	11	2	0	0	1	0	1	0	3	2	4	1	0	1	0	0
Total		4	1	3	6	11	7	8	5	12	4	7	11	24	34	51	24	4	2	11	20	2	8	10	16	19	22	7	0	7	4	11
Max. No. Of Starts	For The Day	1	1	1	1	3	2	3	2	6	1	2	2	8	19	38	8	1	1	3	12	1	3	4	3	3	4	5	0	5	3	9
For Any Unit	For Any Hour	1	1	1	1	1	1	1	1	1	1	1	1	2	5	5	3	1	1	1	1	1	1	1	1	1	2	1	0	1	1	1

Note: The 5 starts per hour occurred in 2 consecutive hours on August 14 and 3 consecutive hours on August 15. See Table IV.

*Today Price is lowest in history**

AND RELIABILITY THE HIGHEST!



Glass bushings, announced just a year ago, have already become one of the most talked-about features of G-E capacitors. These bushings, with the glass fused to a metal ring and the metal ring welded to the case, provide a permanent hermetic seal. Their high mechanical strength combined with this permanent hermetic seal, is improving still further the remarkable long-time record of dependability of G-E capacitors.

With the recently announced five per cent price cut, capacitor prices, which have steadily decreased since 1930, are today the lowest in history.

And, while prices have been decreasing, reliability has gone steadily up. Today, therefore, capacitors are one of the most thoroughly reliable pieces of equipment that can be placed on central station lines.

Concretely, here's what this means to you: Capacitors, which can be installed at less than ten dollars per kilovar, are—without question—one of the most worthwhile buys an electric utility can make. They can help you deliver more kilowatts—right now, in a matter of weeks. And since they normally constitute the ***lowest-cost*** method of increasing kilowatt capacity of generating plants, transmission lines, and transformer banks, they provide the way to "average down" over-all investment per kilowatt. ***Apparatus Department, General Electric Company, Schenectady 5, N. Y.***

**Some temporary war-time prices were slightly lower.*

GENERAL ELECTRIC

407-1

HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN

BURLAP "HAMMOCK" for cleaning contaminated insulators while energized is made of ten oz burlap cut 18 in. wide. First step is to fold over the end to make a one-inch hem, then to thread it onto a wire in one inch pleats

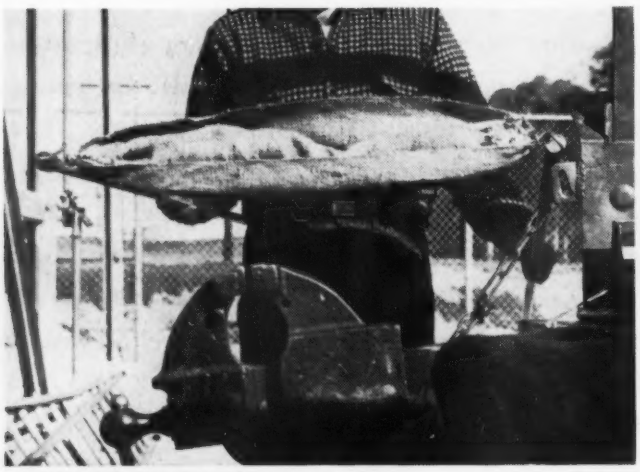
WIRE (No. 9 or equal) is bent around a half-inch rod and the burlap evenly spaced around the bend

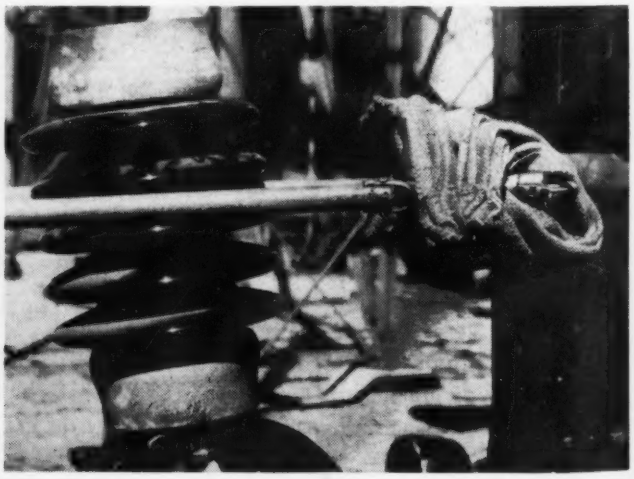
Clean Energized Insulators With Burlap

H. L. RUDOLPH
Assistant Supt of Substations
Southern California Edison Co

DETAILS OF A METHOD for cleaning severely contaminated energized insulators with strips of burlap on insulation rods or "hot sticks" have been carefully worked out by Southern California Edison Co. Accompanying photographs illustrate their technique, which has proved successful even in areas that are subject to both severe industrial contamination and wet salty ocean fogs.

"Hammocks" of voltage tested clean dry ten oz burlap are cut 18 in. wide and several inches longer than the circumference of the insulator to be cleaned. A one inch hem is folded over at each end for reinforcement,



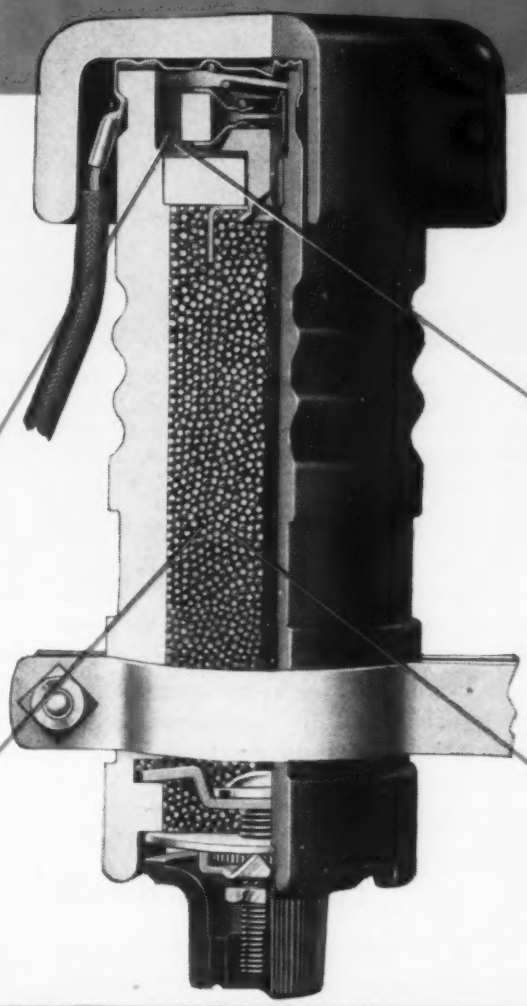


COMPLETED HAMMOCK (left) is shorter on the sides than in the middle. Wire at one end is closed through a bail riveted with a ferrule at the end of a three-quarter inch voltage tested "hot stick" of Douglas fir. Other end is bent into open hook . . . Hammock is rolled on stick (right) to which it is fastened and passed beyond insulator to be cleaned. Other rod on opposite side of insulator engages the open hook

Get that extra protection

SPECIFY G-E PELLET ARRESTERS

The Quality-Standard of the Industry for more than 25 years



For extra protection for your Distribution Transformers

Low initial sparkover voltage to start discharge. The impulse sparkover voltage of a 3-kv pellet arrester, for example, is *less than one third* of the AIEE impulse test level, and *even well below the crest value of the 60-cycle one-minute standard test* of 2400-volt transformers.

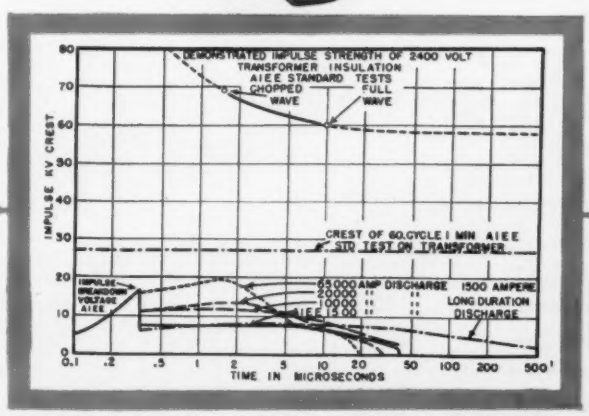
Exceptionally low IR drop during discharge. The efficiency of the G-E pellet type valve-element is tops — it provides valve action and holds lightning voltage stresses to exclusively low levels—while protecting against low, medium, or high lightning currents.

For extra protection for the Arrester itself

Dry Nitrogen is sealed into the gap chamber of all G-E pellet arresters — an *exclusive G-E feature*. This dry, inert gas prevents formation of ozones or oxides — keeps the gap electrodes bright as new during years of service operation.

Pellets, themselves, are of dioxide of lead — *a distinctive valve material whose characteristics are unaffected by moisture*. Therefore, the pellet valve-element is self-protecting against service moisture, condensation or humidity — another reason for pellet arrester reliability.

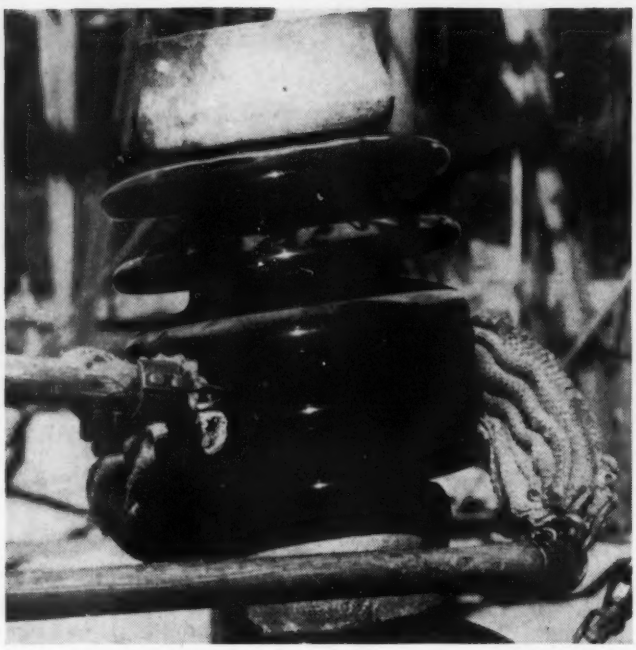
Extra overall protection. This curve was made from actual volt-time and ampere-time cathode-ray oscillograms of a 3-kv G-E pellet arrester. Even at 65,000 amperes discharge current, the maximum voltage stress on the transformer is *but a fraction* of the impulse test level of modern 2400-volt transformers and assures a *wide margin of protection to even very old transformers.*


DEMONSTRATED IMPULSE STRENGTH OF 2400 VOLT TRANSFORMER INSULATION
AIEE STANDARD TESTS
CHOPPED WAVE
FULL WAVE
CREST OF 60-CYCLE 1 MIN AIEE STD TEST ON TRANSFORMER
IMPULSE BREAKDOWN VOLTAGE AIEE
65,000 AMP DISCHARGE 1500 AMPERE
20000 " " "
10000 " " LONG DURATION DISCHARGE
5,000 " " "
IMPULSE KV CREST
TIME IN MICROSECONDS

The G-E pellet arrester *will handle severe lightning stroke discharge currents*—all ratings will readily withstand the AIEE and NEMA standard 65,000-ampere test. And — typical cathode-ray oscillograms obtained on G-E pellet arresters of various ratings, after 6 to 19 years of service where subject to frequent and severe discharges, prove that *pellet arresters retain unexcelled protective characteristics.*

APPARATUS DEPT., GENERAL ELECTRIC COMPANY, SCHENECTADY 5, N. Y.

GENERAL ELECTRIC



ENTIRE CIRCUMFERENCE of insulator may be cleaned from one location by bringing both rods to the same side. Although it has been found that burlap can safely cover an entire 16-kv insulator, usual practice is to work in parts from grounded end

CLEANING TOP SKIRT of 27-kv pin type insulator. With practice this method is also satisfactory for transformer and oil circuit breaker bushings, as well as station post type and most pin type insulators

and threaded on a piece of stiff wire (No. 9 or equal), in tucks or pleats about one in. across. The wire is then bent around a one-half in. rod, and the burlap worked around the bend until it is evenly spaced.

Voltage tested "hot sticks" of three-quarter in. Douglas fir four to ten ft long and painted with clear insulating lacquer are fitted with a ferrule, and a bail or loop is riveted through the ferrule and rod. One end of the hammock is finished to be an open hook, the other is closed through the bail on one of the sticks as shown. All wire and metal parts are made as small as possible.

In use the hammock is rolled on the end of the stick to which it is fastened and passed beyond the insulator or bushing to be cleaned. The open hook is engaged by the other rod, which can then be brought back around to the same side as the first rod, covering the entire circumference of the insulator as shown. While the burlap used has proved to be safe to cover an entire 16-kv insulator, usual practice is to try to clean the insulator in parts, working from the grounded end toward the live end. For certain types of contamination it may be desirable to moisten the hammock with mineral spirits by moistening a paint brush and "flipping" it toward the hammock.

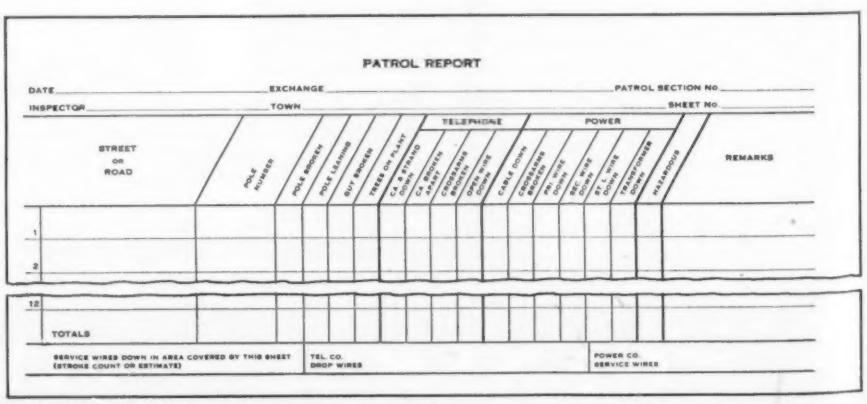
Although first reaction of the workmen may be that the method is awkward and laborious, practice will make them quite proficient. First consideration in developing skill is the proper working position, which should be at right angles to the insulator and a safe distance from energized equipment. Secure footing and plenty of room for arm movements while operating the sticks are also important.

With practice this system will be found to work well on transformer and oil circuit breaker bushings as well as station post type and most pin type insulators.

Emergencies Handled Co-Operatively—II*

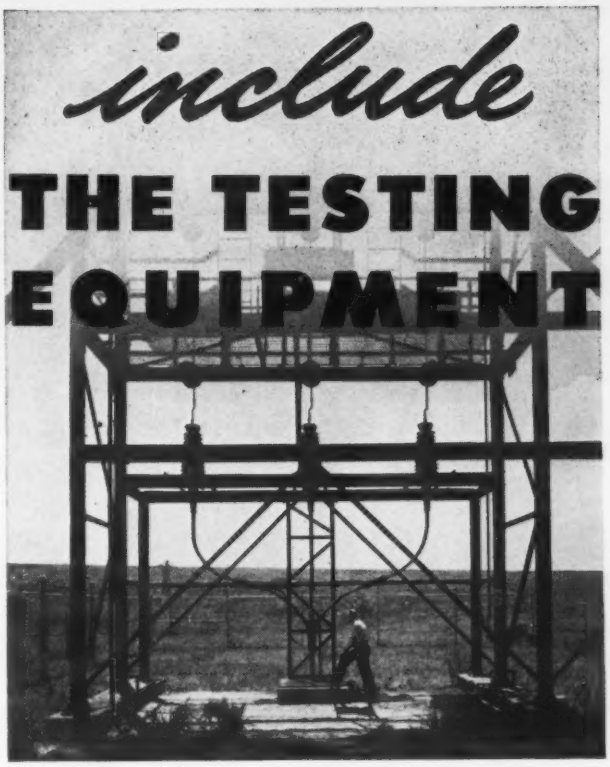
CONNECTICUT UTILITIES survey damage as soon as possible after an emergency occurs. Items covered in the reports that make up the survey are the number, magnitude and location of plant derangements, including poles broken or leaning, trees on plant, sections of electric light wire down, sections of open telephone wire down, crossarms broken, cable damaged,

* This three-article serial began in EW, July 3, 1948, p. 112.



EMERGENCY REPORT on damage to plant

when you order cable

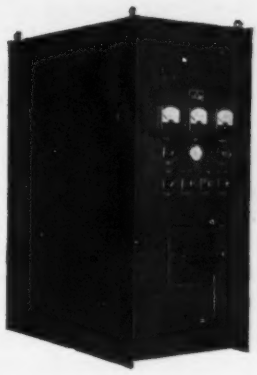


Cable-testing equipment can be included in specifications for a complete cable installation—at a cost that is almost insignificant in the total outlay.

It will pay you to include this equipment. You will have it when you need it—beginning with the acceptance tests, and continuing through periodic testing.

ASK FOR THESE BULLETINS. GEA-3687B gives full particulars on the Cable-fault Reduction and Localization Set. GEA-4595 gives information on the Kenotron set, and includes tables that will be of great value in planning and conducting installation acceptance tests. Both bulletins can be secured from the nearest G-E Apparatus Office, or from *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

these are the sets you will want



The Kenotron
D-C Cable Testing Set

This set utilizes high-voltage direct potential to check condition of cable, and to warn of weaknesses before actual breakdown in service occurs.

Use of d-c for this testing offers these recognized advantages—initial price of equipment is less because lower capacity is required for testing; direct-potential testing, even at voltages approaching breakdown, causes no deterioration of cable insulation; more sensitive indications are possible; in case failure is established during testing, damage is held to the minimum because d-c testing limits the power that can be fed to the fault.

The D-C Fault Reduction
and Localization Set

This set employs the "direct" method of fault location. A continuous, high d-c voltage is applied to the faulty conductor, and when the fault resistance has been reduced, an interrupted d-c tracing current is applied which permits location by an exploring coil and finally by test prods and a galvanometer.

The Fault Reduction and Localization Set is best used in conjunction with a Kenotron testing set. It is the fastest and most positive method of locating faults found in periodic testing—or after a service failure.

GENERAL ELECTRIC

401-52

and when desired, service or drop wires injured.

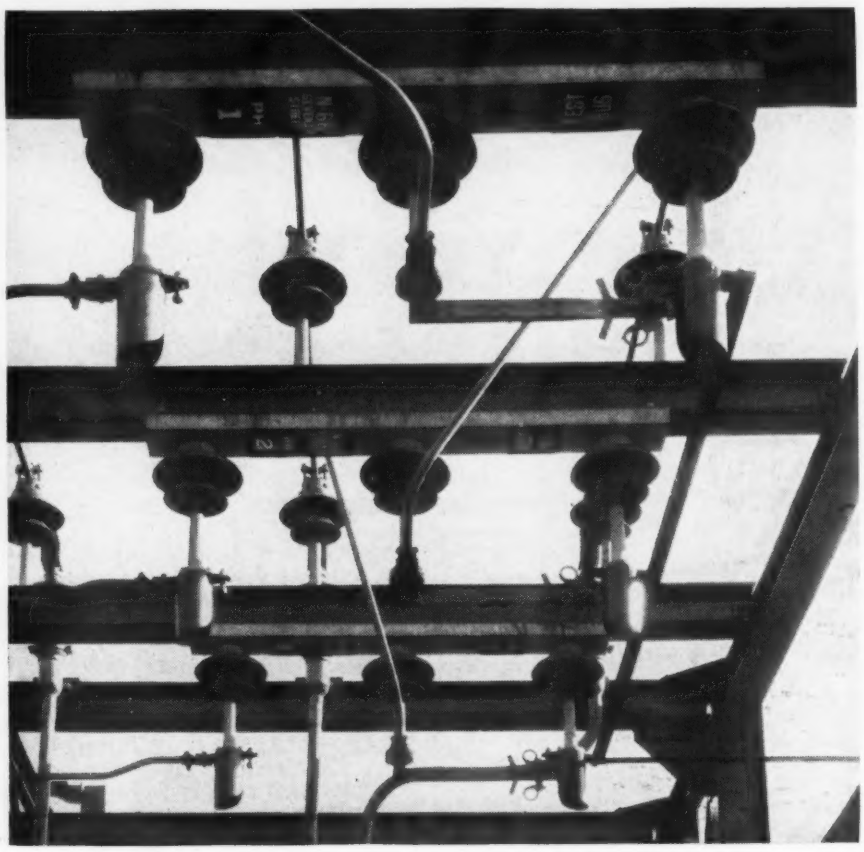
The survey is made by employees of both power and communication companies working separately and not in the same areas. The information obtained is entered upon 8½-in. x 11-in. forms (see illustration) designed to show the data required by each company. From these forms the data become immediately available. The areas covered by the survey are set up by maps. Whenever practicable these maps include a tentative assignment of the area for survey as between companies. This is subject to modification according to conditions existing at the time of the emergency. Before starting the survey the employees are briefed on what to report.

Where unusual numbers of workmen are to be housed in a community which may involve overcrowding, housing agents appointed by each company are expected to co-operate in effecting an equitable division of the available facilities. Where expedient because of the nature of the restoration problems, pole replacements are made by either company regardless of custodianship. Wherever tree trimming or removal work is done on joint plan generally, the facilities of both companies are cleared regardless of which company's crew is actually doing the work.

In caring for individual priority customers, each company follows its own priority list. However, each company co-operates with the other so as to facilitate early restoration of service to all priority customers of both. Where necessary, individual cases are handled through the co-ordinators. Sequence of restoration by each company, in so far as it affects the other, is arranged at the time of the emergency in accordance with the existing conditions.

Immediately upon the advance or apprehended development of an emergency requiring the operation of this co-operative plan, each company appoints an individual to act as a co-ordinator with the other. His qualifications are: (a) He will be well grounded in outside plant problems of his own company and generally familiar with those of the other company; (b) He will be familiar with both companies' policies; (c) He will be thoroughly acquainted with the territory common to both companies.

Procedure for Testing Transmission Lines—II



DISCONNECT SWITCHES on each phase of 26-kv line are stick operated, mounted overhead in inverted horizontal position, and shown closed to test bus

ROLAND R. RHODES
Relayman
Public Service Electric and Gas Co
Hackensack, N. J.

A METHOD is presented for a continuity test of 13 and 26-kv transmission lines, as developed by Public Service Electric and Gas Co. This is in addition to the clearing-up test outlined in EW, July 3, 1948, p 108.

2. Phasing-Out Test. Preparatory to Returning Line to Service.

Should the open-wire or any cable sections of a transmission line be opened for any reason after it has been cleared, grounded and short-circuited, it is necessary to "phase out" the line for proper continuity before returning it to service.

At Station 1, the phase 1 line switch is left in the test bus position and the ground switch is left closed. Phases 2 and 3 line switches are opened from the test bus position.

At Station 2, all three line switches are opened from the test bus position. The 600-v dc- source switch is closed, lighting the test lamp. The ground switch is then opened, breaking the negative side of the test supply and extinguishing the test lamp. Phase 1 line switch is closed to the test bus. If the lamp lights, it shows that the phase 1 conductor is properly connected. This line switch is then opened and the operation repeated for phase 2 and phase 3.

At Station 1, phase 1 is cleared from ground and phase 2 is grounded. At Station 2, the tests are repeated. A third set of tests checks phase 3-line conductor. If all tests prove correct, the line is made available for service.

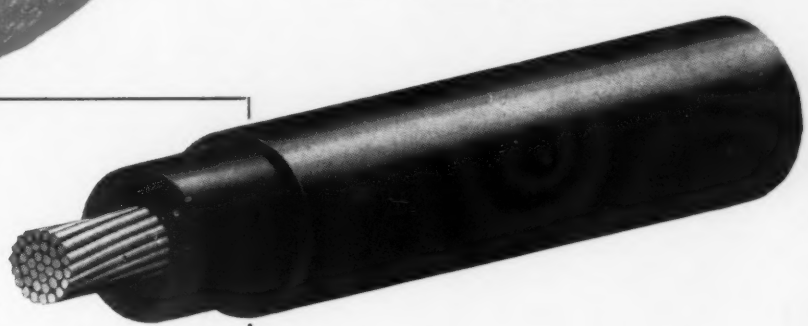
3. Other Tests

The above method of testing for grounds and continuity is also used when a transmission line is automatically removed from service by the operation of protective relays and cannot be restored to service by reclosing the line breaker. If it is impossible to locate the first with the 600-v d-c test procedure, other means are used to break down and locate the fault.

G-E Super Coronol is the only rubber-type cable that is recommended without qualification for operation at 80-C copper temperatures for all voltages up to 15,000.

And this means higher current-carrying capacity, weight saved, a smaller size. Super Coronol carries up to 6 per cent more current below 8000 V than any other rubber-type cable; 14 per cent more, above 8000 V.

But this high efficiency is only part of the story. We are confident that service life at 80 C will be longer than that of other rubber-type cables operated at their *lower* recommended temperatures. Reason is that Super Coronol's butyl-base insulation is essentially inert. This extreme stability defies weather aging, ozone, heat.



TEST GUARANTEES NOW RAISED ABOVE INDUSTRY STANDARDS

So conclusively have all tests proved the superiority of Super Coronol's insulation that we have now raised our *guaranteed* test values above IPCEA and ASTM requirements, giving industry a new standard for rubber-type cable.

SUPER CORONOL EXCEEDS INDUSTRY REQUIREMENTS

PHYSICAL CHARACTERISTICS	IPCEA REQUIREMENTS	SUPER CORONOL
Original		
Tensile strength, lb/sq in.	450	500
Per cent elongation	250	400
Set in 2-in. test piece, in.	½	½
After 7 days in Geer oven		
Tensile strength, lb/sq in.	400 } 70 C	400 } 80 C
Per cent elongation	200 } 70 C	250 } 80 C
Ozone resistance, .03% concentration	3 hours	4 hours
ELECTRICAL CHARACTERISTICS		
Insulation resistance, K value	5280	10000
Power factor, per cent	5	4
Dielectric constant	5	5
COPPER TEMPERATURE		
Up to 8000 volts	75 C	80 C
Above 8000 volts	70 C	80 C

For a high-voltage cable that handles like other rubbers and performs much better, specify Super Coronol. It's made in several constructions. Additional data are given in the bulletin "Some Facts about Super Coronol." Ask your local G-E office for GEA-1788, or write *Apparatus Department, General Electric Co., Schenectady 5, N. Y.*

SUPER CORONOL

gives you

***both* longer cable life**

***and* greater load capacity**

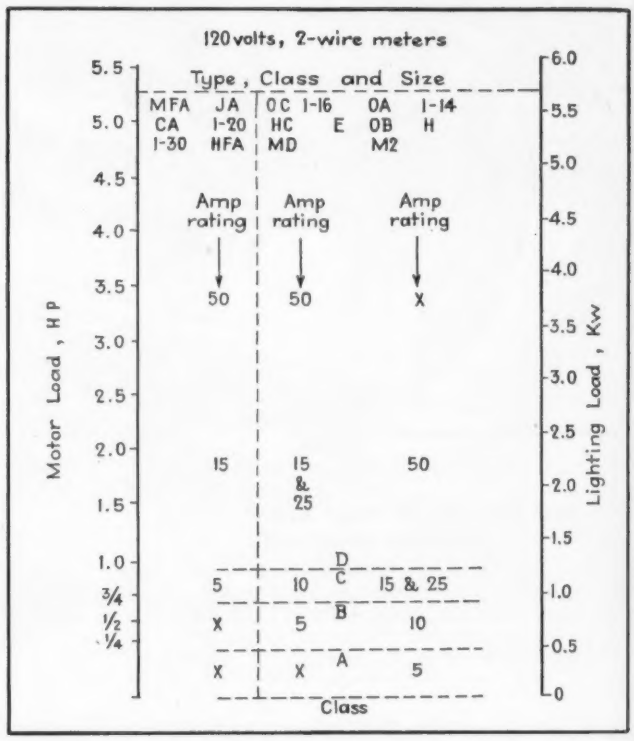
GENERAL ELECTRIC

An Application Guide For Single-Phase Watthour Meters

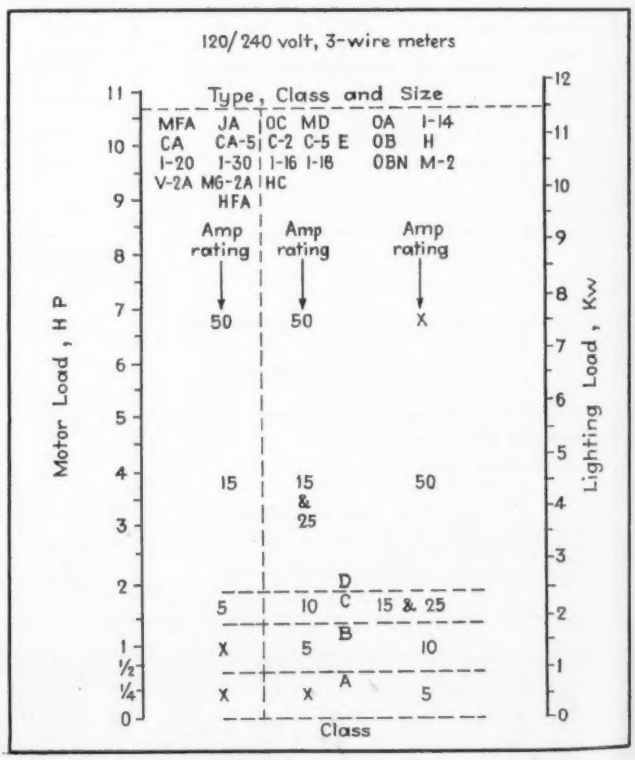
LAWRENCE G. BETZ
Assistant Division Meter Engineer
Public Service Electric and Gas Co
Hackensack, N. J.

ACCOMPANYING NOMOGRAPHS have been developed to determine quickly proper meter sizes and types required for single-phase, 120-v 2-w and 120/240-v, 3-w services.

Power and lighting loads, essentially ampere equivalents of horsepower and kilowatt loads, are added by placing a straight edge to interconnect the load indices. If the load is lighting only, the power index will be zero. Intersection at the middle line gives the meter classification; a reference for meter ampere rating and type. Sizes shown are minimum for connected load.

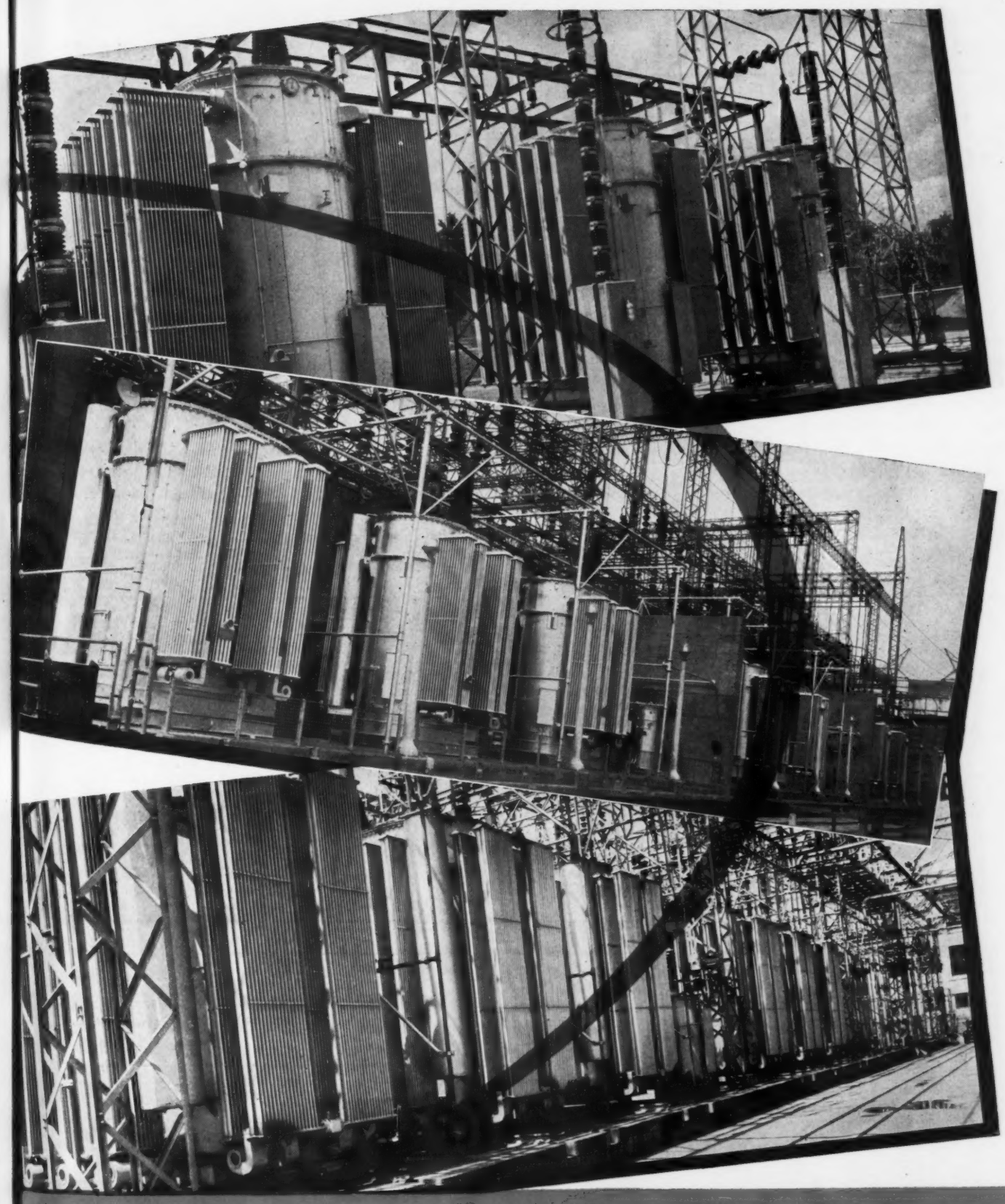


Example: Connected load on a 120-v, 2-w service consists of ¾ hp in motors and 2.0 kw in lights and appliances. When connecting those points on the load indices, the middle line is intersected at classification D. This reference is for either a 15-amp meter of the modern type or a 50-amp meter of the uncompensated type.



Meter classification is based on the following current maximums: A, 7.5 amp; B, 15 amp; C, 20 amp; D, 50 amp; E, 150 amp. For simplicity, 25-amp rated meters are grouped with 15-amp meters. Meters selected according to this guide will not be overloaded to the extent of recording below 99.0% of the accuracy at rated load.

Demand factors may be used if definitely known. But it is recommended that, in the routine use of this guide, connected load be primarily considered.



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POWER AND DISTRIBUTION TRANSFORMERS EXCLUSIVELY SINCE 1896

Selection of Transformer-Bank Ratings For Oil-Field Power Distribution

ACCOMPANYING TABLES may be used as a guide to select transformer-bank rating for oil-well pumping service. The transformer and also the motor rating must be greater than that corresponding to the average pumping load to allow for the extra losses and heating due to the cyclic variations of a pumping unit load.

Transformer-bank kva ratings are listed as consisting of 3 standard commercial single-phase transformers, to serve 1 to 16 motors rated 3 to 60 hp, operating with and without capacitor.

The tables allow for difference in power factor and efficiency for various types of motors and for the extra losses and heating for this type of service. Bank kva rating is applicable for transformers with primaries up to 15 kv and secondaries up to 600 volts, also when voltage drop in secondary line is not over 10%.

For estimating purposes, the transformer-bank rating in kva is taken as equal to the motor horsepower rating. This method assumes that the motor is correctly selected and fully loaded on a pumping cycle. If capacitors of suitable size are used, the bank rating in kva is taken as equal to 75% of the motor horsepower rating.

TABLE I—Approximate Required Transformer Bank Kva Rating[b] (Without Capacitors)[c]

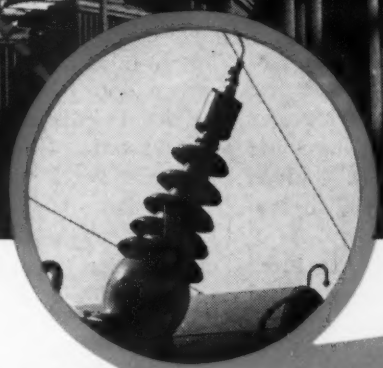
Motor[a] hp	Number of Motors Per Transformer Bank															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
3	4.5	9	9	15	15	22.5	22.5	30*	30	30	30*	45*	45	45	45	45
5	9	15*	15	22.5	30*	30	45*	45	45	45	75	75	75	75	75	75
7.5	9	15	22.5	30	45*	45	75*	75	75	75	75	112.5	112.5	112.5	112.5	112.5
10	15*	22.5	30	45	45	75	75	75	112.5*	112.5	112.5	112.5	150	150	150	150
15	15	30	45	75	75	112.5*	112.5	112.5	150	150	150	225*	225*	225	225	225
20	22.5	45	75	75	112.5	112.5	150	150	225*	225	225	225	300	300	300	300
25	22.5	45	75	112.5	112.5	150	150	225*	225	225	300	300	300	300	300	450
30	30	75*	75	112.5	150	150	225*	225	225	300	300	300	450	450	450	450
40	45*	75	112.5	150	225*	225	300	300	300	450	450	450	450	600*	600	600
50	45	112.5*	150	225*	225	300	300	450	450	450	450	600	600	600	....	....
60	75*	112.5	150	225	300	300	450	450	450	600	600	.....	.....	....	....	....

TABLE II—Approximate Required Transformer Bank Kva Rating[b] (With Capacitors)[d]

Motor[a] hp	Number of Motors Per Transformer Bank															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
3	4.5	4.5	9	9	15*	15	15	22.5	22.5	22.5	22.5	30	30	30	30	45
5	4.5	9	15*	15	22.5	22.5	30	30	30	45*	45	45	45	45	75	75
7.5	9	15*	15	22.5	30	30	45	45	45	75*	75	75	75	75	75	112.5
10	9	15	22.5	30	45*	45	75	75	75	75	75	112.5*	112.5*	112.5	112.5	112.5
15	15*	22.5	30	45	75*	75	75	112.5*	112.5*	112.5	112.5	150	150	150	150	225*
20	15	30	45	75	75	112.5*	112.5	112.5	150	150	150	225*	225*	225	225	225
25	22.5	45*	75	75	112.5*	112.5	150	150	150	225*	225	225	225	300	300	300
30	22.5	45	75	112.5*	112.5	150	150	225*	225	225	300	300	300	300	300	450
40	30	75	112.5*	112.5	150	225*	225	225	300	300	300	450	450	450	450	450
50	45*	75	112.5	150	225*	225	300	300	300	450	450	450	450	450	600	600
60	45	112.5*	150	225*	225	300	300	450	450	450	450	600	600	600	....	....

Notes for both tables:
(a) Motors up to 20 hp are high-starting-torque type. Motors above 20 hp are normal-starting-torque type.
(b) Transformer kva on basis of 3 single-phase transformers. Those marked with asterisk (*) could use next smaller standard-size three-phase bank.
(c) For estimating purposes, transformer kva equals motor horsepower rating.
(d) For estimating purposes, transformer kva equals 75% motor horsepower rating, based on power factor of 97.5%.

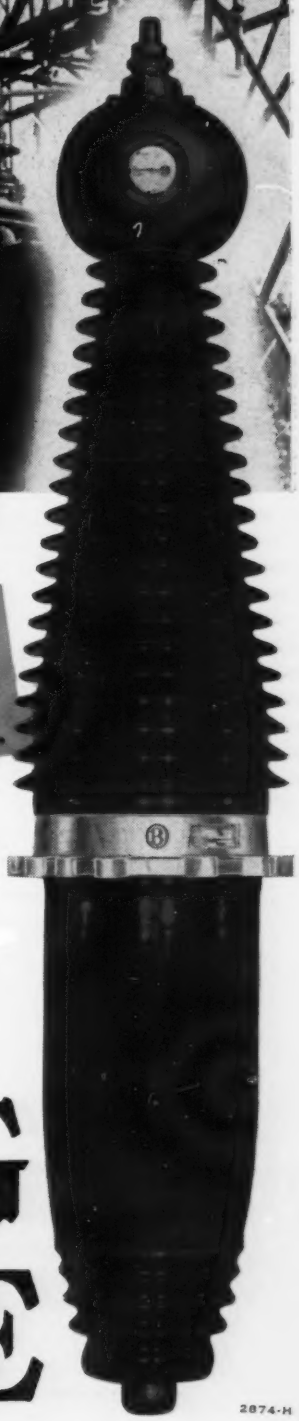
Where Dependability *Counts!*



Ohio Brass

MANSFIELD, OHIO

Canadian Ohio Brass Co., Ltd., Niagara Falls, Ontario



Half a million people--their jobs, their safety, their comforts--have depended on these O-B bushings for many years and, in all probability, will for many more years to come. Installed on the 132-kv outgoing transformers of a 300,000-kw generating station in a metropolitan community, these O-B bushings have carried a heavy responsibility and have discharged it without ever contributing to a power interruption. The ruggedness built into these bushings has been retained in the basic O-B design and only reinforced by modern improvements. To duplicate this same kind of reliability on your own system, specify O-B oil filled bushings on your new apparatus.

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INEXPENSIVE LIGHTING scheme for unattached distribution substations uses PAR-type spot and flood lamps to lighting switches and transformers during night switching and inspections. Spot and flood lamps (right) are mounted on 2-in. pipe post

Low Cost Lighting For Unattended Substations

ACCOMPANYING PHOTOS show an inexpensive spot and flood-lighting scheme used by Pennsylvania Power & Light Co, Hazleton, to illuminate small unattended 66-12-kv substations during night-time switching operations.

The usual arrangement has three 150-w PAR-type projector spot and flood lamps mounted on a crossarm atop a 2-in. pipe post of appropriate height, usually 3 ft or more inside the substation fence. Two spot lamps and one flood are commonly used.

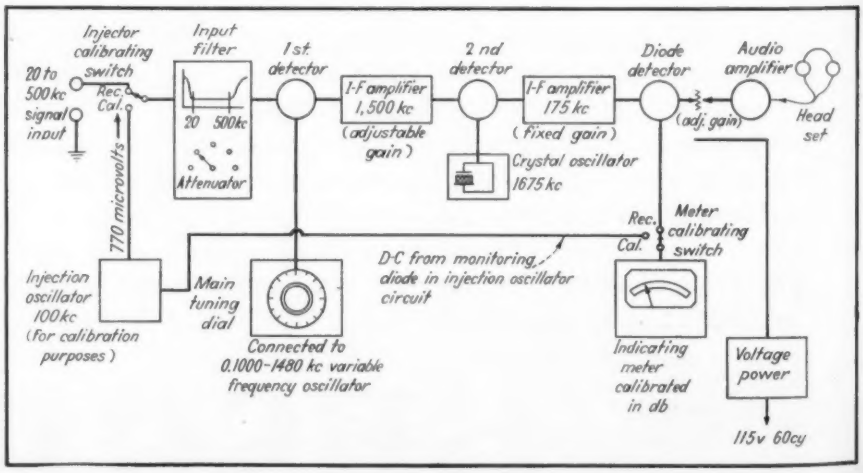
The lamps are operated from an outdoor toggle switch mounted for convenience on conduit just inside the substation gate.

Carrier Voltmeter Aids Channel Maintenance

R. L. BRINTON
Pacific Gas and Electric Co.
San Francisco, Calif.

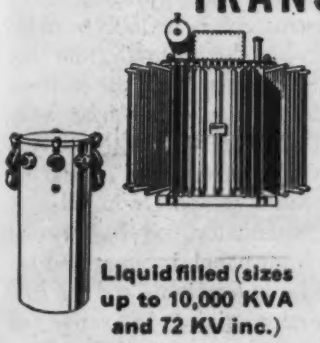
CONGESTION RESULTING from greatly increased use of carrier current equipment has made it very difficult for utilities to engineer and maintain communication and signal channels with conventional test instruments. Instruments originally used to check output of transmitters and attenuation on transmission lines of the Pacific Gas and Electric Co proved inadequate. This happened not only where several frequencies were used on one circuit, but also by induction from adjacent channels. In some instances signals from radio transmitters broadcasting in the carrier range were picked up on transmission lines and measured as carrier frequencies.

After considerable investigation and development PG & E has written a set of specifications for a tunable carrier frequency vacuum tube voltmeter which can be tuned to any desired frequency from 20 to 500 kc. Twelve units manufactured to these specifications have already become al-



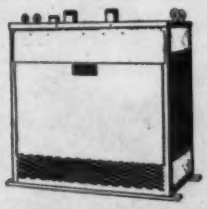
BLOCK DIAGRAM of instrument. Variable attenuator provides range of —80 to +40 dbm for any frequency from 20 to 500 kc, without interference from adjacent channels or external sources. Built-in calibration oscillator and adjustable gain audio amplifier have simplified testing set-up considerably

TRANSFORMERS FOR EVERY APPLICATION

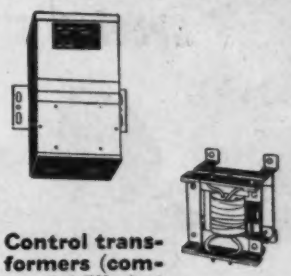


Liquid filled (sizes up to 10,000 KVA and 72 KV inc.)

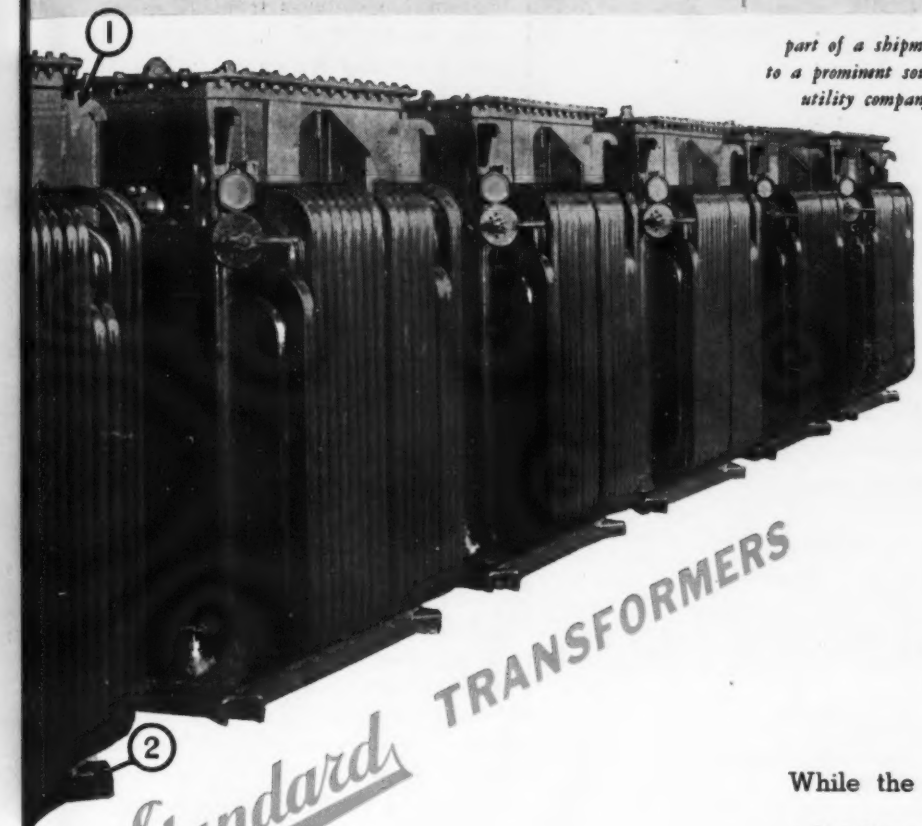
Instrument transformers (for use on circuits up to 72,000 volts, inclusive)



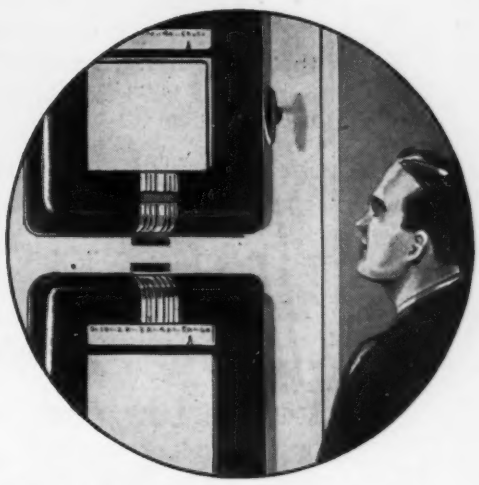
Dry type (up to 1000 KVA and max. voltage ratings of 4800)



Control transformers (compound filled or open type)



part of a shipment to a prominent southern utility company



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Your requirements built into every unit.

Standard's network transformers are giving uninterrupted service in congested, heavy-load areas. The maximum of flexibility is provided to accommodate changing load requirements and to permit efficient servicing. They are designed with a minimum of bulk to overcome space problems. Standard's unit substations eliminate the need of costly extra conduit and cables.

While the elements and tanks of Standard's substations conform to general basic designs, your installation requirements are built into every unit. Terminals, bushings and externally mounted auxiliary equipment are located to fit your individual specifications. Switches, and other devices are used as you specify. Our engineers work with you and make Standard's products work best in your operation.

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WARREN, OHIO

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Distribution and Power · Current and Potential · Askarel Cooled · Rural
General Purpose Dry Type · Auto Transformers · Street Lighting

HERE'S WHERE
SPECIAL SWITCHES are STANDARD

When a *standard* snap switch won't do your *special* job . . . that's when ESCO can help you. Over 90% of our production is special in one way or another.

Special

. . . contact arrangements
. . . operating sequences
. . . load combinations
. . . control handles
. . . terminal provisions
. . . multi-stage groupings

SPECIAL LOW COST, too . . . made possible by our use of standard, uniform components, assembled by experts in the construction of snap switches *specially* built for your *special* job.

THESE BASIC FEATURES
can be standard in your special switches.

CURRENT RATINGS . . . 10, 30, 60, 100 and 200 amperes
VOLTAGE RATINGS . . . up to 460 volts a-c
NUMBER OF POLES . . . one to 20
NUMBER OF POSITIONS . . . 4
HANDLE STYLES . . . oval, pistol-grip or removable
MOUNTINGS . . . base or panel
CONNECTIONS . . . side or rear

Don't lose valuable time hunting in catalogs for a *standard* switch for your *special* need . . . just write us your requirements and we'll give you full details on the ESCO switch that meets your specification.

* This ESCO switch, used for oil circuit breaker control, comprises a 2PDT, 30-ampere, 3-position, spring-return unit with a DPST, 10-ampere auxiliary; specify No. 8431A.

ELECTRO SWITCH CORP.
193 BROAD ST. WEYMOUTH 88, MASS.

most indispensable to the company in their communication work.

The instrument is actually a radio receiver with d-c output from the final detector operating an indicating meter as a vacuum tube voltmeter. This meter is calibrated to indicate values of voltages appearing at the voltmeter input terminals. A variable attenuator, also adjusted from the front panel, is connected between the input terminals and the first grid, thereby giving a range of measurable voltages from 77 microvolts (—80 dbm) to 77 v (+40 dbm) for any frequency in the 20-500 kc range. For calibration the instrument has a built-in injection oscillator or signal generator with a fixed known amplitude signal which can be switched into the input circuit. One other feature is a listening jack on the front panel with a built-in adjustable-level audio amplifier to provide a head phone output when the instrument is used as a carrier frequency receiver. For detailed description of the electrical circuits refer to the accompanying block diagram.

Serves Dual Role

In actual practice the unit has been quite versatile, serving the dual role of a testing instrument and also providing communication during tests. By using an audio oscillator specially designed to generate a maximum power output of 5 watts and with an arrangement provided for modulation, it is possible to set up a carrier channel. When transmission tests are run over telephone or power lines, it is possible to use the same instruments for a carrier communication channel as are used for the transmission tests.

Frequent Readings

By operating an inverter from a car battery as a source of 115 volts a-c, it is possible to take frequent carrier frequency voltage readings along open wire telephone lines and locate causes of excessive carrier frequency attenuation. The carrier frequency voltmeter is most valuable when isolating troubles on a carrier communication channel. By connecting the instrument across the line terminals of the carrier, quick checks indicate whether the local carrier transmitter is functioning properly and whether a signal of proper value is being received from the distant carrier transmitter.

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Specify CHANCE *Tools*

and get these extra features:

1. Installing bar, tamp and anchor retriever combined in one tool.

2. Safe, reversible point pike pole with reinforced butt — wire lift attachment.

3. Maul with seasoned hickory inserts to prevent damage when driving anchor rods.

4. Trip auger—bores like a bit, telescoping rod from 5 to 8 feet, adjustable reamer for various hole sizes, easy dump trip.

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6. Transformer gin with new light weight aluminum fitted chain tightener. Easy to apply. Has safety lock.

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CRAFTSMAN
ALL STEEL SERVICE BODIES

● Because we are devoting our entire facilities to service bodies exclusively you will find Artisan Products a dependable source for light utility service body needs.

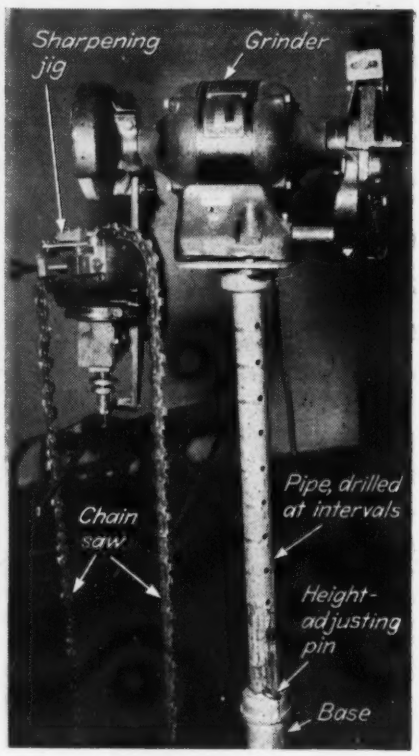
Two models are available: No. 75 for use on ½ ton chassis and No. 90 for use on ¾ and 1 ton chassis. Either type may be installed on your chassis at our plant or crated and shipped to destination.

Optional equipment includes 5 different types of ladder racks—sliding steel roof—partition trays—rubber goods compartment, etc. Call on us. Prompt deliveries.

WRITE for bulletin illustrated—it contains detailed information on both models—full specifications—tables of dimensions and weights—optional and accessory equipment. Quotations upon request.

ARTISAN PRODUCTS, INC.
Specialists in All Steel Service Bodies
3540 WEST 140TH STREET • CLEVELAND 11, OHIO

Adjustable Sharpening Stand Protects Saw Teeth



TO PROTECT CHAIN SAWS during sharpening, Monongahela Power Co's substation maintenance shop at Fairmont, W. Va. developed this adjustable stand. It raises the sharpener above the level of the bench and so keeps the chain clear of the floor. A standard grinder and Disston chain saw sharpening jig are mounted on top of a pipe, drilled at intervals to accommodate the height-adjusting pin. The assembly is supported by a tripod base

British Stress Safety In Mining Machine Cables*

R. A. SCHATZEL
Rome Cable Corporation
Rome, N. Y.

ANALYSIS of British training cables indicates that U. S. engineers may profit from some of their safety practices, such as are used in cable design and failure protection. In general, the English practice involves a-c rather than our conventional d-c power, and voltages of the order of 600 to 750. This probably accounts for some differences in cable designs.

All British cables are round. There are no flat-twin or even concentric types recognized. All cables contain at least three conductors, including a grounding conductor. This practice

* From Conference Paper "Improvements in Mining Machine Cables" presented at 1948 AIEE General Meeting.

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OIL CIRCUIT RECLOSER

LOOKING to the increased loads of tomorrow, the Kearney engineers designed this OCR with larger physical dimensions, greater oil capacity and greater arc quenching ability.

These oversize features reduce maintenance and oil changes are required at less frequent intervals.

Built with heavier double arc inhibiting contacts and full rated 15,000 volt bushings, this is truly the OCR of tomorrow, available today.

A bulletin with complete technical data is available on request.

Immediate shipment from stock.

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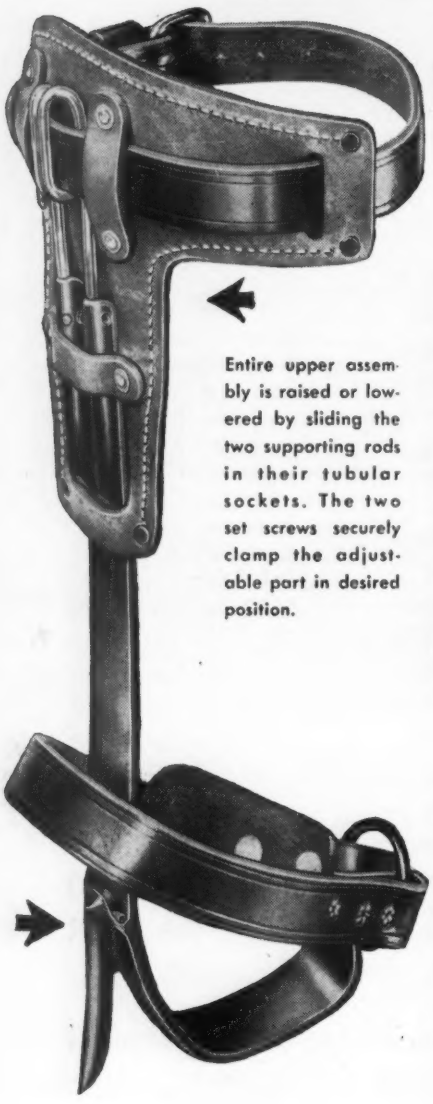
One Pair of Climbers That Will Fit Every Lineman

Buckingham



Entire upper assembly is raised or lowered by sliding the two supporting rods in their tubular sockets. The two set screws securely clamp the adjustable part in desired position.

Gaff is replaceable by driving out the "Driv-Lok", then forcing the gaff down and out.

ADJUSTABLE Climbers

Correct size in climbers — to fit the biggest or the shortest man on the crew — is on hand with *every* pair of BUCKINGHAM *Adjustable* Climbers. Each adjustable climber can be lengthened or shortened over the full range from sizes 15 to 18½. Linemen get a better fit with adjustable climbers . . . the exact length that fits best, instead of to the nearest half-inch. All the safety and comfort that has made Buckingham climbers famous among men who use climbers, will be found in them.

The feature of replaceable gaffs eliminates discards because of blunted or broken gaffs. The gaff is locked to the body of the climber at an angle which will not permit it to become disengaged in normal use. The angle of the gaff permits the lineman to stand closer to his work with less possibility of cutout, and also makes climbing easier.

BUCKINGHAM Adjustable Climbers are fitted with leg and foot straps, and BUCKINGHAM de Luxe leather pads filled with rubberized wool for greater comfort . . . they feel right the first time worn.

Linemen get *greater comfort* and *safety* from their climbers, *and* fewer pairs are required to keep every man on the job, when you standardize on BUCKINGHAM Adjustables. Ask about them at your supply house, or write directly for descriptive bulletin

BUCKINGHAM MANUFACTURING CO., INC.

Walter E. Craw, President — 5-7 Travis Street, Binghamton, N. Y.

has been in effect for several years. Many of their trailing cables utilize electrically shielded power conductors for safety. This shielding is obtained by copper wire shield braids over the conductor insulation. Or, more recently, by the use of conducting rubber surrounding the insulation and the bare grounding conductor. Although not new, pilot conductors are used for fault protection circuit connections and have wide application.

Conductor Make-Up

Conductor make-up follows U. S. practice, except that all individual wires are stranded in the same direction. This provides added resistance to breakage obtained by kinking or twisting. British continuous current ratings are less than ours—especially on the larger sizes. For No. 1 Awg for example, they specify 71 amp as against our 110 amp. This difference is less on sizes smaller than No. 4 Awg. This means less overload and voltage drop than obtained by most American practices.

Insulation grade and thickness is equivalent to that in U. S. Filler and sheath material is Neoprene. This gives the same degree of flame-resistance as for U. S. cables.

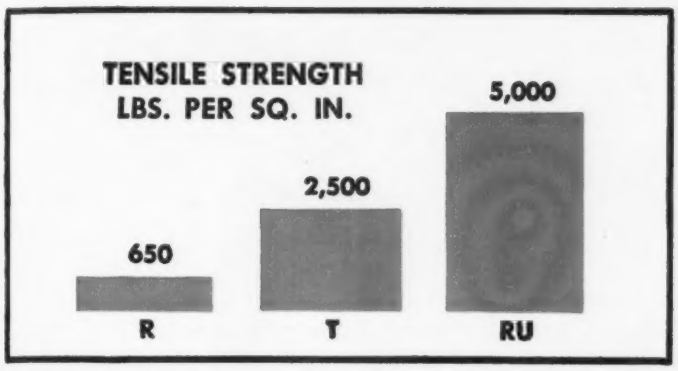
Overall diameters of the British cables have been standardized for some time. They are slightly larger (0.020 to 0.060 in.) than present U. S. standards.

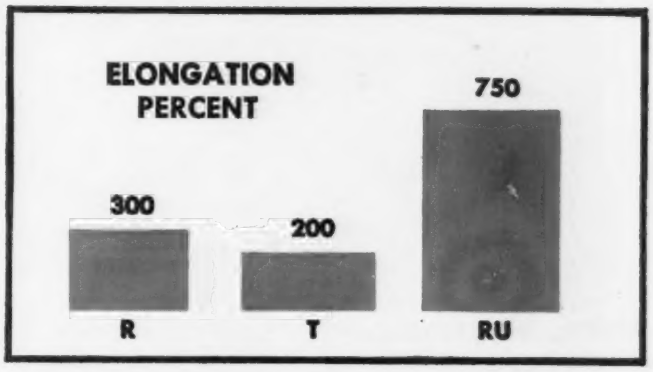
Cable design itself is fairly well standardized according to the various end uses. For example, galvanized steel-wire armored cables are used for such machinery as conveyors and loaders. All drill cables, which operate at 72 v to ground, contain five conductors. They comprise three power conductors, a ground conductor, and a pilot conductor. Shielding may or may not be used. The chief difference in their various drill cables is in the length of lay of the five conductors. A very short lay is used for a cable length of less than 10 ft adjacent to the drilling machine. Cable with a longer lay is used from the coupling box to the gate end switch controlling the supply.

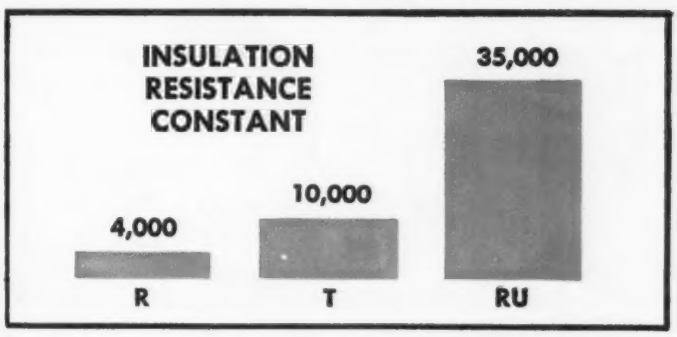
In England all connections to portable machines are made by a plug and socket. The British system of ground leakage protection is of value in preventing withdrawal of the plug when the circuit is alive.

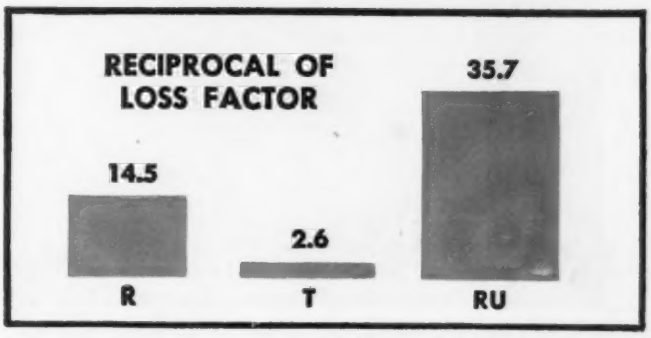
SMALLER DIAMETER CONTROL CABLES INSULATED WITH *Laytex**

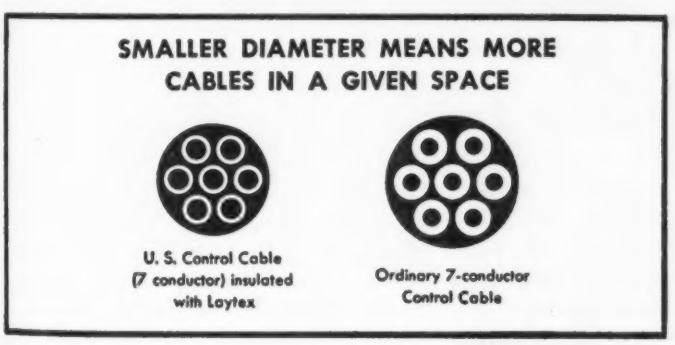
COMPARE *Laytex* ELECTRICALLY AND PHYSICALLY











Three common types of insulation used on the conductors of control cable are:

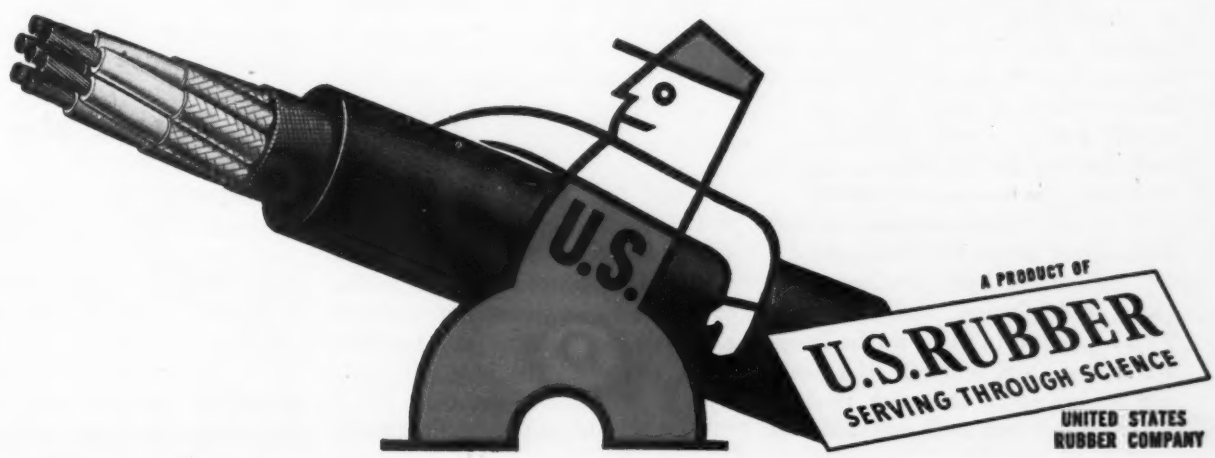
Type R—The copper conductor has a code rubber insulation.

Type T—A copper conductor with thermoplastic (a synthetic compound) insulation.

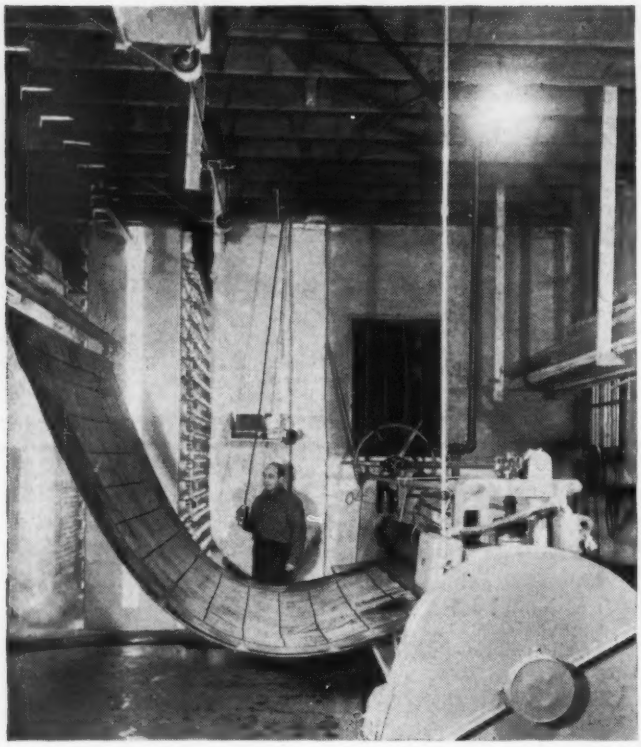
Type RU—LAYTEX. This type has a copper conductor, *natural rubber insulation.*

The charts above show the wide margin by which LAYTEX leads in physical and electrical qualities. It is one reason why U. S. Control Cables will continue, as in the past 16 years, to provide the finest service obtainable. For more information, write Wire and Cable Department, United States Rubber Company, 1230 Avenue of the Americas, New York 20, N. Y.

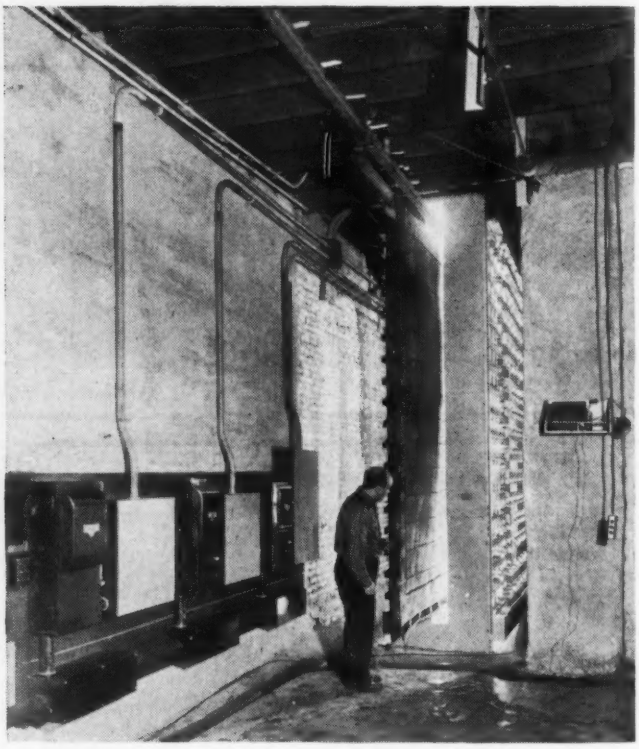
**Reg. U. S. Pat. Off.*



LOAD BUILDING



RUG LEAVES WRINGER, then is carried on trolley into drier in background



RUG WILL HANG in drier 8 to 20 minutes, depending on type

Infrared Dries Rugs Faster

W. W. CLOUSE
Consolidated Gas Electric Light and Power Co
Baltimore, Md.

TO DRY A RUG after washing now takes 8 to 20 minutes at the Peerless Carpet Cleaning Works in Baltimore. Previously, it required 24 hours or more for ordinary air drying, and 6 to 8 hours in a 130-deg F dry room. Infrared does it, and according to Jerome Senker, manager of Peerless, does it better, giving the dried article a soft fluffiness and bright appearance lacking in the other methods. Also, valuable floor space is saved.

The installation consists of 408 R40, 250-w lamps in 2 facing banks, 102 kw. Each bank consists of 17 rows of 12 lamps. The rows are 9 in. apart and in the rows the lamps are set on 12-in. centers. The banks are 30 in. apart, the work thus 15 in. from the heat source. Moist air and steam are exhausted and fresh air supplied by blowers. An electronic moisture controller, its leads clipped to the edge of the rug, rings a bell when drying is finished. Estimated energy consumption for steady use of the equipment is 19,000 kwhr per month.

An Axminster rug requires about 8 minutes to dry; a Wilton rug, 12 minutes; a heavy Chinese Oriental, 20 minutes; and a light-weight Oriental, about 8 minutes. Rugs containing cotton have a longer drying time, which increases with the percentage of cotton. The user states that there is no changing of color and no shrinking. These are two questions which seem to be foremost in the carpet cleaner's mind.

Modern School Lighting Demonstrated

SOME 500 EDUCATORS, architects and representatives of manufacturers, school builders and suppliers, participated in a concentrated promotion of school improvement with primary emphasis on lighting at Mansfield, Ohio, recently. The idea originated with R. W. Butts of the Ohio Public Service Co which serves Mansfield.

The project was to bring up to the very last minute of modernization one or more classrooms and use them as demonstrations in a well-organized, statewide school lighting conference. The John Simpson school in Mansfield was chosen to be the example because it had a suitable auditorium for the conference and classrooms

the new Guthlite* is

3 WAYS More Economical!

1

Economical to Install

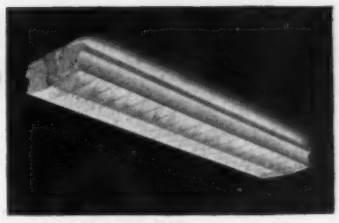
The ballast-free channels are hung first—either on the ceiling or suspended—singly or in continuous rows. Then follows simple, straight-through, unobstructed wiring. Finally, the complete reflector unit, which includes louvres, ballast, and all accessories, is put up in one simple, hook-on operation from the floor. No need to carry heavy loads up shaky ladders. This simplified installation saves time, effort, and cost.

2

Economical to Maintain

A revolutionary new maintenance principle has been introduced in the GUTHLITE! No more ladders! No more fuss, muss, or bustle! The entire maintenance operation—lamp replacements, starter changes, cleaning—*everything*—is easily, speedily handled—right from the floor—thanks to the patented Jacknife Hinge! The handy maintenance rod makes possible these tremendous savings in time, labor, and inconvenience.

3



Economical to Use

A GUTHLITE installation means triple economy in use. First, because there are no horizontal light-reflecting surfaces to gather dust, light output retains maximum efficiency. Second, because GUTHLITE is so easy to maintain, the lighting efficiency is held at consistently high levels. And third, because of their easy seeing, direct-indirect illumination, GUTHLITE adds to the productive work of the people using the light! A real three-way economy in use.

THE Edwin F. Guth COMPANY
ST. LOUIS 3
LEADERS IN LIGHTING SINCE 1902

*Trade Mark. U. S. & Canadian Patents Applied for

Write for full details about GUTHLITE. Ask for Bulletin 4845B

that lent themselves readily to the purposes of the demonstration.

W. L. Miller, Mansfield superintendent of schools, was most helpful in arranging and staging the conference.

After the conference several companies presented to the school the equipment they had furnished for the demonstration rooms. Exclusive of equipment, the cost of labor and materials for relighting the rooms and staging the conference was:

Wiring*	$443.41
Painting and refinishing	287.95
Labor furnished by local power company	160.46
Lamps	96.00
Janitor service	15.00
Daylight diffusers	108.54
Conference mailings and publicity	325.00
Total	$1,436.36

*Surface wiring would have saved about $200.

Per visitor, these costs average to $2.87, which is not expensive promotion, considering that the installations remain as inspiring examples.

"Easy Selling"

H. E. CARNEY
Toledo Edison Co

SOMETIMES a very little effort in selling will produce large results. An instance is a 3-week display of special purpose lamps in the Main office windows of the Toledo Edison Co last April. Some 25 infra-red, ultra-violet sun, and germicidal lamps, furnished by 14 dealers and distributors were shown in their particular applications. All the company did was to set up the window display and run one newspaper advertisement announcing it. All the lamps in the display were in operation and cards attached to each explained its characteristics and purposes. It was safe for the public to look directly at the operating lamps because the plate glass windows of the storefront obviated any danger of exposure to harmful rays.

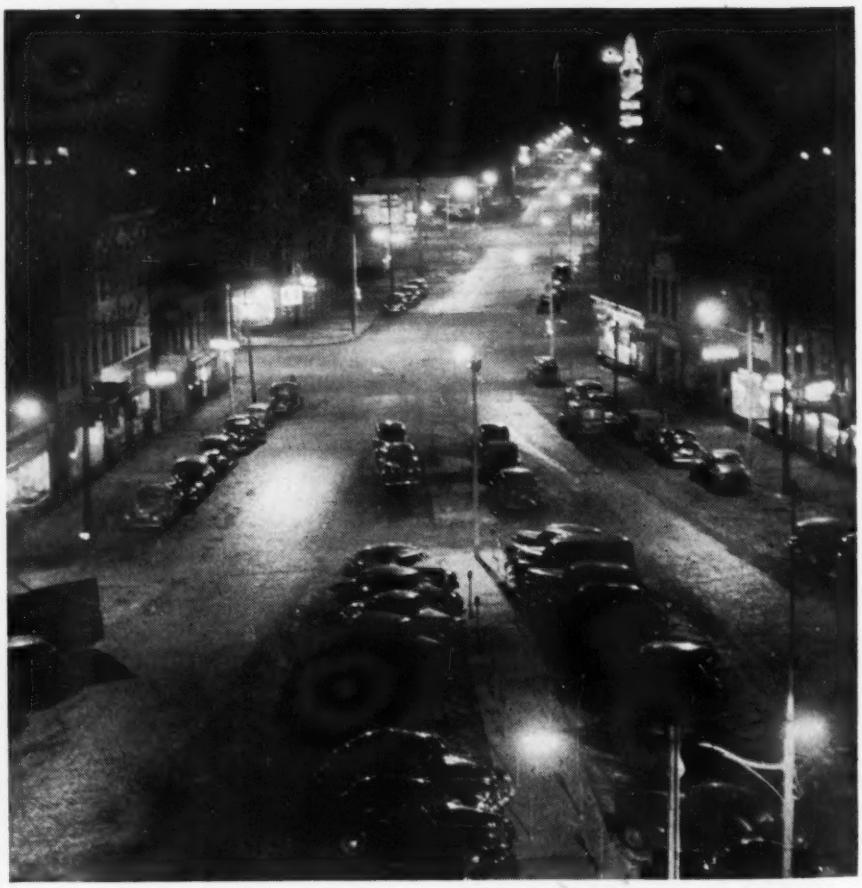
Typical of the results was the immediate purchase of 50 milk can sterilizers by a dairyman who now is boosting sales by advertising his use of completely sterile milk cans. A bowling alley proprietor bought 6 shoe sanitizers and now loudly proclaims that no one gets athlete's foot in his establishment. Before the display was removed practically all the local dealers' stock of special purpose lamps and fixtures had been sold out. One dealer put on a special salesman to follow up leads and calls created by their ad and display. Two separate dealers inquired how much the rent would be for display of their goods in the company's windows.

Police Praise Mercury Street Lights

ROCK ISLAND, ILLINOIS, POLICE declare that mercury-vapor street lighting recently installed in their city is a law enforcement tool "as important to us as two-way radio". Not only are the downtown streets brilliantly lighted but the officers can see clearly down all the alleys. A bandit was trapped in the downtown area and illumination from the new lights was so good that police were able to shoot accurately and get their man without danger to passersby.

The new lights are 400w, 20,000-lumen mercury units. They illuminate 37 blocks of arterial streets. There is a light in the center of every alley in the business district, too. Now the alleys are brighter than the main streets used to be. The former system of lighting in Rock Island produced ‡ ft-c illumination at street level. Using about half as much wattage, the new system gives 2 ft-c between corners and 4 at each of the intersections.

As in other cities where mercury lamps are used for street lighting, color of the light is found to be no problem. Illumination from signs and spill from show windows is ample to compensate for the characteristics deficiency of the mercury lamp at the red end of the spectrum.



Westinghouse Electric Corp Photo

LAW ENFORCEMENT in Rock Island gets a helping hand from modern street lighting which illuminates alleys and areaways and leaves no places in which law breakers can skulk and hide

information

ON WIRES, CORDS AND CABLES

for every use!

NOW — to make the selection of wires, cables, and cords easy — get your free copy of the new, complete catalog of General Electric *Building Wires, Cables, and Cords.* In one easy-to-use book, this new catalog lets you make your choice from the *complete* line. It includes wires, cables, and cords for every use — for industrial, manufacturing, and building applications.

Partial list of contents covers:

Thermoplastic Building Wires

Rubber-insulated and Leaded Building Wires and Cables

BX* Armored Cable

PVX Nonmetallic Sheathed Cable

Service Entrance Cable

Flamenol* Cords

Rubber Jacket Cords

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Please send me the new, free catalog *Building Wires, Cables and Cords for every purpose.*

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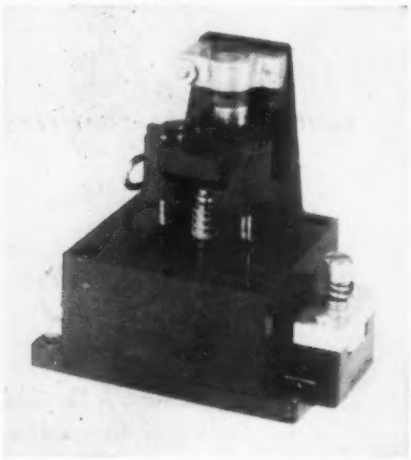
Wires and Cables

GENERAL ELECTRIC

NEW EQUIPMENT

Timing Relay

A PNEUMATIC TIMING RELAY is announced by The American Controller Co, 528 W. Van Buren St, Chicago 7, Ill. The unit is designed for use in industrial control applications where a delayed circuit is required after energization or de-energization for operations performed in time sequence. The



type M pneumatic timer is adjustable from ½ sec to 5 min or longer if required. It can be mounted in any position and attached to a contactor, or it is possible to actuate the timer mechanically by any moving machine part or by a separate electromagnet.

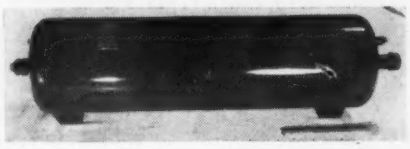
The active part of the Type M dashpot is a diaphragm. A check valve permits unrestricted air entrance, and the air entrance chamber is controlled by a needle valve. This valve can be adjusted by a knurled thumb screw which is locked in every position by a spring ratchet. A felt filter at the air inlet keeps dust out of the needle valve and the air chamber.

Rating: Single pole, 15 amp, 110 v; 10 amp, 220 v; 6 amp, 440 v; 5 amp, 600 v a-c; and ½ amp. 115 v; ¼ amp, 230 v d-c.

•

Oil Conditioner

AN AUTOMATIC thermosiphon oil conditioner with no moving parts is announced by Westinghouse Electric Corp, Box 868, Pittsburgh 30, Pa. The unit is reported to absorb moisture, acid, and sludge from transformer oil continuously while the transformer is



in operation. Units mounted on old or new transformers are said to maintain properties of transformer oil or Inerteen essentially the same as those of new transformer liquid dielectrics for as long as the absorbent material remains effective. The conditioner is manufactured for Westinghouse by the Honan-Crane Corp of Lebanon, Indiana.

Trial installations are claimed to have shown that the conditioner holds neutralization number, power factor, dielectric strength, and interfacial tension to proper values for good operating practice with no other reconditioning necessary. Oil should test satisfactorily when the conditioner is installed.

The conditioning agent is held within an all-welded steel tank, dome shaped at both ends, about 4 ft long and 12 in. in diameter weighing complete 167 lb without oil. The conditioning agent is in ¼- to ½-in. granules.

•

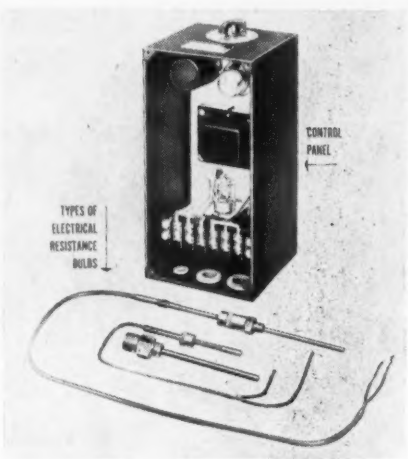
Garden Light

KNOWN AS THE FLORALITE, a garden lighting unit is being introduced by the Stever Mfg. Co. of Broadview (Maywood), Ill. It can be plugged into a convenient outlet. The unit consists of an amber globe mounted on a 24-in. long shaft with an 8-in. push-in ground base to hold the lamp upright.

Temperature Controller

A TEMPERATURE controller, said to be simple, fast, and precise, has been developed by the Instrument Division of Thomas A. Edison, Inc, West Orange, N. J. The device uses a single electronic tube with an electrical resistance type bulb for thermal pick-up and is of the on-off type.

Use of the resistance bulb permits location of the sensing element at a point remote from the control panel. This device, which is non-indicating, may be used to control temperatures to close tolerances in solids, gases, or liquids. Units are available to cover the



temperature range from minus 100 F to plus 1200 F and are adjustable within a range of several hundred degrees.

Supply voltage may be 115 or 230 v, 50-60 cycle. Load capacity is 30 amp at 115 v, 20 amp at 230 v. Accuracy of the controller is independent of usual voltage variation. Normal response time is under 3 sec due to the patented bulb construction. A 5x5x10 in. control panel, weighing less than 8 lb, complete, is furnished.

•

Adhesive Cable Wrap

NO-OX-ID COATING in an adhesive roll is announced by Dearborn Chemical Co. 310 S. Michigan Ave, Chicago, Ill.

The product combines two steps in cable protection: A corrosion-resistant coating and a sturdy wrapper. It eliminates separate applications. The wrap is water repellent. Corrosion-inhibitive

7 POINTS OF SUPERIORITY

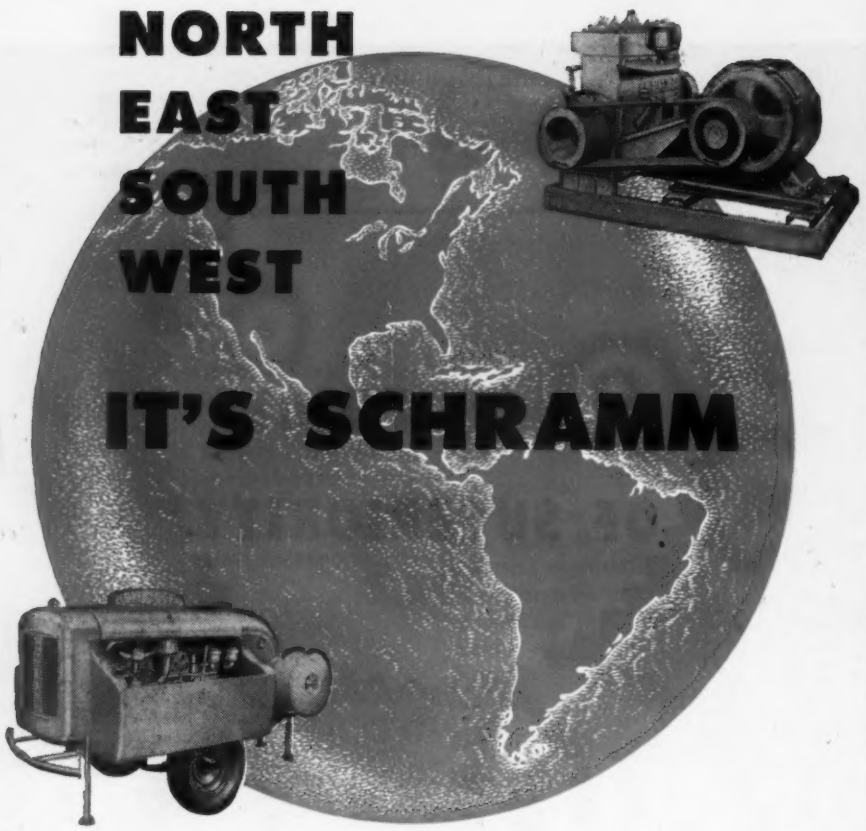
HUB·RAK

THE PRIMARY RACK FOR SECONDARY SERVICES

- **EXPERIENCE**—Hub-raks are backed by the manufacturing experience of 105 years in the durable goods field.
- **LABOR SAVING**—Perfect alignment of points . . . mount back-to-back, on same through bolts, line or service types. Easy insulator replacement.
- **LONG LIFE**—Hubbard double dip hot galvanizing assures a rust-resistant rack that will outlast your lines. Complete drainage.
- **STRENGTH**—Forged steel points rigidly attached through back to form a single, integral unit . . . broad backs . . . periodic check tests.
- **UTILITY**—Standard sizes and spacings . . . extended and non-extended backs . . . styles for heavy and light work.
- **EFFICIENCY**—All sizes . . . complete line of accessories . . . bolt or lag mounting . . . back-to-back mounting on same bolts.
- **DISTRIBUTION**—Stocks in all principal cities of the United States.

HUBBARD AND COMPANY

PITTSBURGH, PENNA. CHICAGO, ILL. OAKLAND, CALIF.



SO VERSATILE

. . . because Schramm can furnish air for any compressed air job in your work; and versatile because there is a size and model Schramm to fit your individual needs! Just specify the size you need.

SO EASY TO OPERATE

. . . merely by pushing a button to start, and compact and lightweight enabling you to move the portable units wherever you like! Meanwhile, the stationary units take up very little room, are vibrationless and no trouble!

SO ECONOMICAL

. . . because Schramm can do *all* your compressed air jobs quickly and efficiently. Features that assure economy include 100% water cooled, forced feed lubrication, and mechanical intake valve.

it pays to use Schramm!

Your field has found that Schramm Air Compressors well fit its needs. And has specified Schramm everywhere . . . North, East, South and West. Write today for full data.

TOOLS FOR THE JOB

Schramm Inc. also has a complete line of Pneumatic Tools to offer and recommend for operation by their Compressors.

These include Rock Drills, Paving Breakers, Trench Diggers, Clay Spades, Backfill Tampers, Tie Tampers, Sheeting Drivers, Demolition Tools, Chain and Circular Saws.

Write for bulletins and prices.

SCHRAMM INC.

THE COMPRESSOR PEOPLE • WEST CHESTER • PENNSYLVANIA

qualities provide a protective film to keep cable free from pitting.

One man can apply it, simply by manually winding the wrap spirally, with a ½-in. overlap, directly around the cable. Uniform thickness promotes smooth coverage. Firm bond is maintained; possibility of voids eliminated.

The wrap is 3/32-in. thick. Rolls: 2 in. wide; 25 ft. in length. Each roll is cellophane wrapped for film protection. individually packaged.

•

Liquid Wire Stripper

STRIPPING of electrical wires is speeded by the use of "Formula 21," recently developed for removing Formex, Formavar, enamel and similar wire insulating coatings. The liquid stripper is a product of Aircraft-Marine Products, Inc, 1656 North 4th St, Harrisburg, Pa. Its use is simple: merely dip wire in liquid and wipe off with rag or blow off with compressed air. No scraping, tools or special cleaning is required. This new product is said to be non-corrosive, non-inflammable, and will not harm fabrics., wood, or metal. Available in 2-oz. bottles, 1 and 5-gal. cans, "Formula 21" is applicable for use in mass production as well as for repairs to motors, coils, relays, and similar electrically wired equipment. More details are given in Catalog Section 71.

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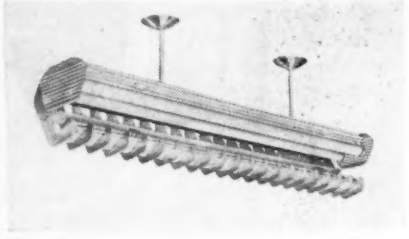

Fluorescent Unit

A NEW SERIES-louver type of fluorescent luminaire for individual or continuous row mounting has been made available by Miller Co, Meriden, Conn. This C-62 series unit may be mounted flush to the ceiling or suspended from

SPRINGS that remain constant for life

. . . one of the reasons why Westinghouse instruments are good!

Westinghouse-made springs keep their shape and torque for life. "Spring set" is eliminated. Phosphor-bronze alloys are precision-rolled to extremely close tolerances. Calibration accuracy is uniform and permanent over the entire scale length. Rigid torque inspection assures uniform tension characteristics for every type of service. Each spring is tested individually.

And so it is with every other component of Westinghouse instruments . . . each part especially perfected for harmonious relation with all other parts . . . and all parts designed and built by one manufacturer . . . Westinghouse. Such undivided responsibility of manufacture accounts for the life-long accuracy of all Westinghouse instruments.

For any problem concerning electrical instruments and their application, consult a Westinghouse instrument specialist. Call your nearest Westinghouse office or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-40351

★ ★ ★

IMMEDIATE DELIVERIES on many instruments . . . others up to 90 days.

Westinghouse INSTRUMENTS

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Built for Unfailing Performance

ONLY TRICO FUSES

CAN GIVE YOU SO MANY ADVANTAGES

With TRICO Fuses it's THREE TIMES THE SERVICE . . . maximum production protection . . . increased revenue. TRICO Fuses are the choice of engineers where dependable fuse protection is required.

TRICO **COLORTOP FUSES**
THE COLOR TELLS THE SIZE

Nothing has been spared to give Public Utilities, Industry & the General Public an over-abundance of plus values. Here's what you get:

- EASY SELECTION—QUICK INSPECTION
- SHOCK-PROOF PORCELAIN TOPS
- BOTTOM VENTILATING—NO BURNS
- ALWAYS SHOW WHEN THEY BLOW
- LESS LOSS OF TIME-REVENUE
- UNDERWRITERS LAB. APPROVED

WRITE FOR BUL. NO. 3

TRICO's *Famous*

RENEWABLE FUSES

- With The CUSTOM-BUILT "Powder-Packed" Element

You get: Guaranteed results . . . TAMPER-PROOF protection . . . Safe time-lag . . . Link protection and support . . . Life-time outer parts.

WRITE FOR BUL. NO. 1

TRICO's *Famous*

"KANTARK" DEPENDABLE ONE-TIME FUSES

The quality of material and workmanship used in the construction of TRICO "Kantark" Fuses makes them high grade in every detail . . . You get:

- Perfect Connections . . . link securely riveted & soldered.
- Solid, non-rusting brass caps
- Wide, cool operating fusible links.
- Smooth, perfectly aligned copper blades.
- Heavy rivets—no screws—therefore TAMPER-PROOF.

WRITE FOR BULLETIN NO. 2

TRICO FUSE MFG. CO. Milwaukee Wisconsin FUSES

Jenkins Bros. also make Diamond Seal Friction and Rubber Tapes which meet ASTM and Federal Specifications.

GOLD SEAL TAPE grips tight, forms a firmer, longer lasting bond that just won't let go, Winter or Summer. It is stronger, tears cleaner, won't ravel or peel. It's "hot stuff" for faster, better jobs. Try Gold Seal Tape! Cellophane wrapped, in single rolls or the handy, sealed 10-roll can. Jenkins Bros. (Rubber Div.) 80 White Street, New York 13.

JENKINS *Gold Seal Tape* FRICTION...RUBBER

MADE BY JENKINS BROS . . . MAKERS OF FAMOUS JENKINS VALVES

stem hangers. The louver assembly swings open (see illustration) from either side for ease in cleaning and relamping. Louvers and end plates are in aluminum with body of the fixture in white. Catalog folder 2G gives additional information.

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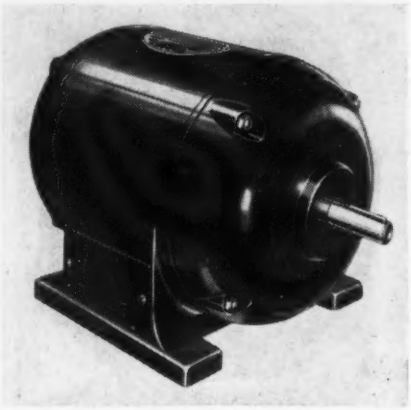

Induction Motors

A LINE OF CAPACITOR-START, induction motors for heavy duty is announced by King-Wyse Inc, Archbold, Ohio. They are offered in single phase at 1, 1½, and 2 hp, 60 cycle, 110/220 v at 1750 rpm, and in three phase at 1, 2, and 3 hp, 60 cycle, 220/440 v, at 1750 rpm. They have the following features: aluminum alloy housing and bell end; prelubrication and sealed ball bearings that permit mounting motor in any position; stators that are dual voltage wound; temperature rise of only 40 C; overload of 100%. Rotation is electrically reversible by a switch. Frame is said to be drip proof.

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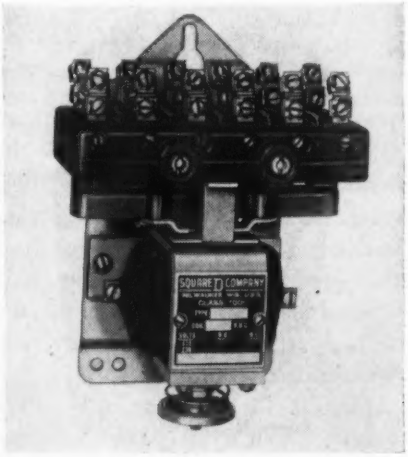


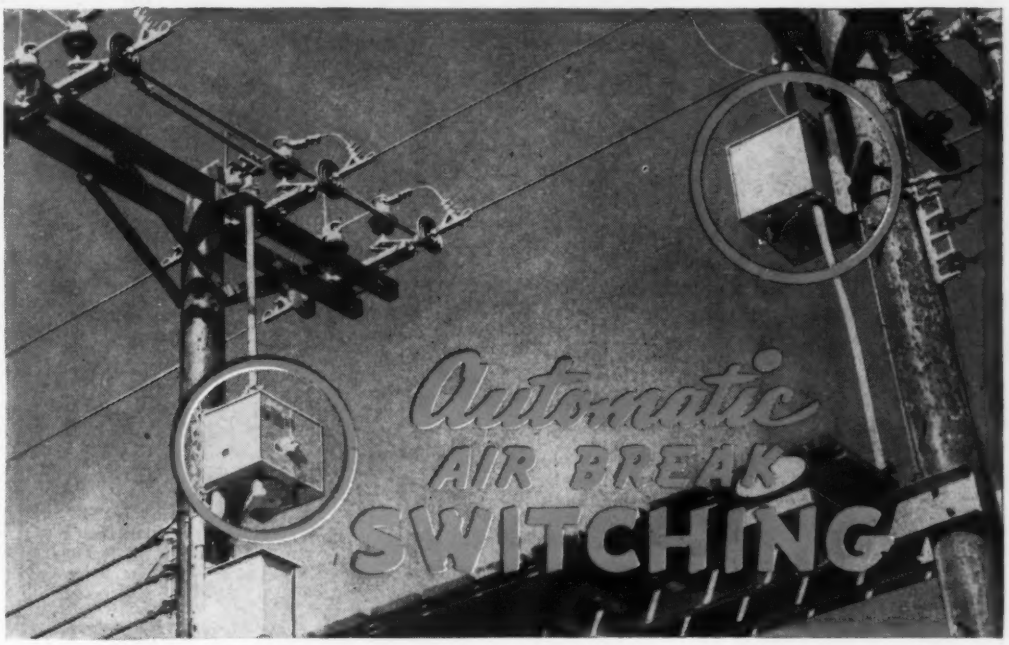
D-C Relays

TWO D-C RELAYS have been added to the line of machine tool controls of Square D Co, 4041 North Richards St, Milwaukee 12, Wis. These magnetic multipole units have contact parts interchangeable with those of the cor-

DEPENDABLE

Complete Constant Control

- **LOAD TRANSFER**
- **TROUBLE ISOLATION**
- **LINE SECTIONALIZING**



MINIMIZE CUSTOMER OUTAGES!

Assurance of uninterrupted power is a very important phase of your engineering program, particularly now with systems heavily burdened and output at an unprecedented level. Assure your customers of uninterrupted service through the use of Southern States' motor—or spring—operated mechanisms, or a **combination of both in the same cabinet.**

LOAD TRANSFER

Can't afford power interruptions? Southern States automatic air break switches transfer a load **instantaneously**—or after a predetermined delay—from a preferred to an emergency source when trouble strikes, returns it upon restoration of voltage.

TROUBLE ISOLATION

When faults occur, isolate them. Southern States automatic air break switches quickly isolate faulted branch lines, enable system service to continue.

LINE SECTIONALIZING

Here, again, rely on **automatic** control. Southern States automatic air break switches are available for sectionalizing loop transmission and distribution circuits, and radial feeders. Switching equipment is also available for remote control by an operator.

Southern States Equipment Corp.

HOME OFFICE AND FACTORY — HAMPTON, GEORGIA

REPRESENTATIVES IN FOLLOWING CITIES:

BIRMINGHAM, ALABAMA
LOS ANGELES, CALIFORNIA
SAN FRANCISCO, CALIFORNIA
DENVER, COLORADO
WASHINGTON, D. C.
JACKSONVILLE, FLORIDA
MIAMI, FLORIDA
ATLANTA, GEORGIA
EVANSVILLE, INDIANA
VALPARAISO, INDIANA
LOUISVILLE, KENTUCKY
NEW ORLEANS, LOUISIANA
SHREVEPORT, LOUISIANA
BOSTON, MASSACHUSETTS
JACKSON, MICHIGAN
KANSAS CITY, MISSOURI
ST. LOUIS, MISSOURI
NEW YORK, NEW YORK
CHARLOTTE, NORTH CAROLINA
PHILADELPHIA PENNSYLVANIA
CHARLESTON, SOUTH CAROLINA
KNOXVILLE, TENNESSEE
MEMPHIS, TENNESSEE
DALLAS, TEXAS
HOUSTON, TEXAS
LUBBOCK, TEXAS
SALT LAKE CITY, UTAH
SEATTLE, WASHINGTON
MILWAUKEE, WISCONSIN

STOP FIRE FASTER!

WITH THE MASTER OF FLAME ANSUL* FIRE EXTINGUISHING EQUIPMENT

DRY CHEMICAL

ANSUL MODEL 350 A

FIRE EXTINGUISHERS

MORE AND BETTER FIRE PROTECTION FOR YOUR FIRE EXTINGUISHER DOLLAR

Ansul Dry Chemical Fire Extinguishers give you more protection . . . pound for pound . . . dollar for dollar . . . than any other extinguisher of comparable size.

In addition . . . Ansul Fire Extinguishers provide the best first-aid protection:

- For electrical equipment hazards . . .

TRANSFORMERS, GENERATORS, CIRCUIT BREAKERS, MOTORS, ETC.

Ansul Fire Extinguishers have the highest established ratings for effectiveness on flammable liquid fires, based on tests by nationally recognized approval agencies. The longer range stream of dry chemical is effective in winds and drafts.

After use, Ansul Dry Chemical Fire Extinguishers can be recharged "on the spot" . . . providing continuing protection . . . and annual recharging of Ansul extinguishers is NOT necessary.

Safe to use . . . non-toxic, non-corrosive, non-abrasive.

Ansul Dry Chemical Fire Extinguishers are preferred fire protection in the utilities field and for electrical equipment hazards in all industries.

Ask for your copy of file No. 204. You will receive factual data on how Ansul Dry Fire Chemical Extinguishers will cut your fire protection costs.

Listed and approved by Underwriters' Laboratories and Factory Mutual Laboratories.

Ansul Model 30

Ansul Model 20

Ansul Model 4

ANSUL CHEMICAL COMPANY
FIRE EXTINGUISHER DIVISION, MARINETTE, WISCONSIN
DISTRIBUTORS IN ALL PRINCIPAL CITIES

responding a-c devices. The silver-to-silver contacts are double break and can be converted from normally open to normally closed.

The relays are steel panel mounted and insulated to permit direct mounting on a grounded metal panel. The type Q is available with 2 to 6 poles and the type R, somewhat larger and heavier, has 2 to 5 poles. Both are suitable for voltages up to 250.

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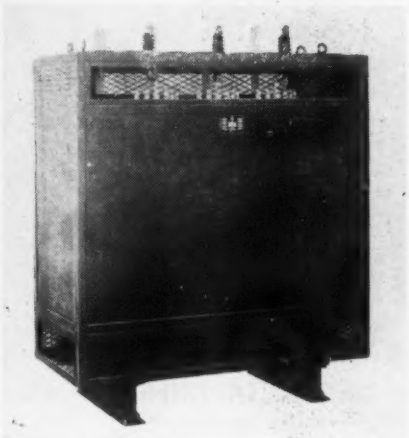


Air Cooled Transformer

AN IMPROVED line of dry transformers, designated as type F has been announced by Marcus Transformer Co, Inc., 35 Montgomery St., Hillside 5, N. J. Features include the use of Class B insulation, such as air, fibre-glass, mica, asbestos, porcelain, etc., and Class C materials (in conjunction with bare copper).

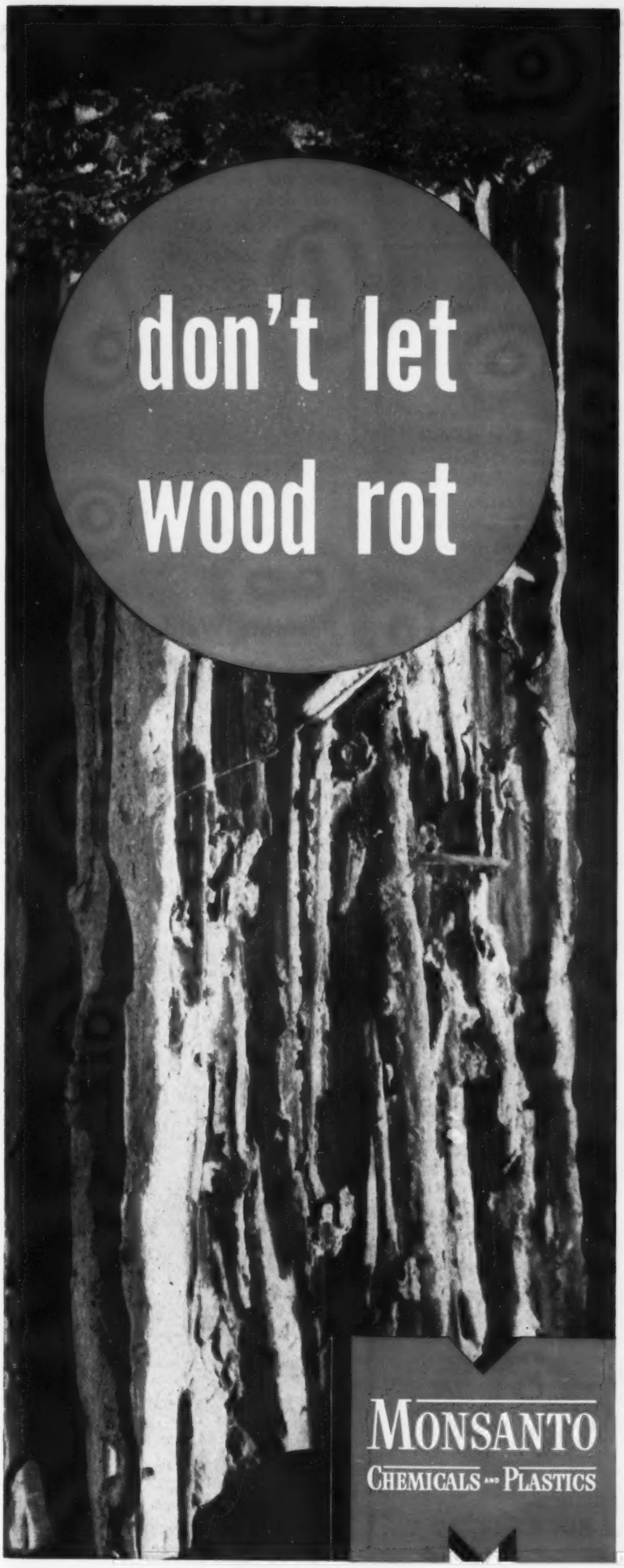
Primary tap switch is standard equipment. Case is constructed to protect transformer element against flooded floor conditions and, at the same time, provides means for the addition of blowers for forced draft in the event future conditions require loading in excess of transformer rating. Available in sizes from 100 to 1000 kva, single or three-phase, in voltages to 15,000 v. Unit illustrated is 500 kva. 4160/120/208 Y, 60 cycles, 3 phase.

•

Electronic Control

A NEW CONTROL SYSTEM using a small electron tube is announced by the Otis Elevator Co, 260 Eleventh Ave, New York, N. Y. This system eliminates the large amount of electric wiring and many relays formerly used for elevator operation.

The landing fixtures used with the new control system are similar in appearance to the ordinary push button fixtures. An electronic tube is behind each button-like disk in the landing fixture at each floor. There are two disks in each fixture, one for up calls



save it with . . .

Pentachlorophenol

Monsanto's SANTOPHEN 20

Utilities are turning more and more to the use of pentachlorophenol to safeguard their huge investments in wood. The demonstrated ability of pentachlorophenol to prolong the life of poles, crossarms, posts and structural timbers of all types cuts wasteful expenditures for maintenance and replacement —amply repays its low original treating cost.

Santaphen 20 prevents damage caused by termites, rot and fungus growths. Its killing power is always laboratory controlled—this is your assurance of long-lasting, dependable protection.

For latest application and technical data on Santophen 20, write to MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 S. Second St., St. Louis 4, Missouri, or simply return the coupon.

Santophen: Reg. U. S. Pat. Off.

SOME MAJOR INDUSTRIAL APPLICATIONS FOR SANTOPHEN 20

Transmission Lines (poles and crossarms)
Fences (posts and rails)
Structural Timbers (bridge decking, loading platforms, roofs, water towers)
Dimension Lumber (framing, joists, rafters)
Millwork (trim, exterior finish)

MONSANTO CHEMICAL COMPANY EW-4
Organic Chemicals Division
1700 South Second Street, St. Louis 4, Missouri

Please send me application and technical data on Santophen 20.

Name_____ Title_____
Company_____
Address_____
City_____ State_____

SERVING INDUSTRY . . . WHICH SERVES MANKIND

Simply slide DOSSERT BOLTLESS Connector into an end of tubular bus.

Then slide end of other bus over connector up to shoulder of connector.

Only several hammer blows on the key. Lock by screwing in set screws with pointed end of same key.

Connection is complete, streamlined, and secure. (Disassembled just as quickly).

Dossert BOLTLESS CONNECTORS

Patent No. 2198964

FOR CONNECTING TUBULAR BUSES QUICKLY, ECONOMICALLY

•

Installed in a jiffy . . . supplied as a single unit, already for complete installation.

A new, unique type of bolt connector. Eliminates time-wasting tightening and taping of old-style clamp connectors. Provide permanent, vibration-proof grip. High conductivity copper alloy construction. Available in all types of fittings, such as: couplers, reducing couplers, T connectors, elbows, and in various corresponding combinations of tubular bus and cable.

Particulars on request to Dept. 2

DOSSERT MFG. CORP.
249-255 HURON STREET, BROOKLYN 22, N. Y.
SINCE 1904

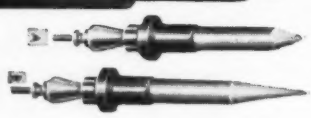
REVOLUTIONARY *New* SOLDERING IRON

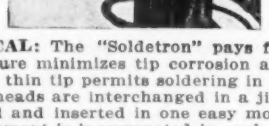
TRANSVISION Soldetron

Trade Mark Reg., U. S. Pat. Off., Pat. Pend.

- Weighs only 3 ounces, yet it can do the job of a 200 watt iron.
- Readily interchangeable tip-heads; no cleaning or filing.
- Easy to use for every type of soldering.

Fingertip control . . . Permits long periods of soldering without fatigue . . . High working output . . . Low current drain.





Ready for attachment and operation on 110 V A. C., 50 - 60 cycles, through transformer supplied with iron, or 6-8 volt A.C. or D.C. without transformer (from an automobile battery).

Overall size 9¼" x 15/16"; ship. wt. approx. 4 lbs.

IDEAL FOR PRECISION WORK: Revolutionary in design, this featherweight precision iron has all the advantages of light weight and small size, making it **ideal for fine precision work in "hard-to-reach" places.**

NEW FEATURES: Weighs only 3 ounces . . . **Heats up in 20 seconds from a cold start** . . . Fingertip button permits control of temperature to suit any operation . . . . **Retains heat with switch off up to one minute,** then requires only 3 seconds to reheat for operation at maximum efficiency . . . Bakelite handle with cork covering insures comfortable **cool grip.**

EFFICIENT, ECONOMICAL: The "Soldetron" **pays** for itself in a few months . . . Intermittent control feature minimizes tip corrosion and eliminates the need for frequent cleaning . . . Long, thin tip permits soldering in inaccessible places as in instrument work, etc. . . . Tip-heads are interchanged in a jiffy . . . Various types are available, and can be removed and inserted in one easy motion . . . **No more fussing with frozen tips** . . . Heater element is incorporated in each tip-head . . . To test the life of the tip-heads they were heated to approximately 1800°F.; during this severe test, the tip-heads did not burn out.

PRICE, including transformer and Tip-Head "A", **$13.95**

Distributors now being appointed. Write for full details.

MANUFACTURERS: *Order an initial unit;* prove its great efficiency.

TRANSVISION, INC., DEPT. EW, **NEW ROCHELLE, N. Y.**

and one for down calls. When the disk is touched, a translucent arrow surrounding the disk lights up to show that the call is registered. The light has high visibility.

With registration of a call the car automatically stops level with the floor and the doors open. The operator's only duty is to register car calls, close the doors and start the car.

•

Portable Welder

A NEW LIGHT-WEIGHT portable welder of the gasoline engine-driven type is announced by Lincoln Electric Co, Cleveland 1, Ohio. This welder, known as the "Linewelder," with 20-180 amp range, is approximately 2 ft wide, 2 ft high, 4 ft long, and net weight is 502 lb.

Some features are: Output panel has provision for three ranges of current; generator controls are enclosed in cabinet over generator, cooling being through fan on generator shaft; welder is powered by a Wisconsin air-cooled, 2-cylinder engine, with speed adjusted between 1800 and 2300 rpm for welding current; mounting rails permit attachment to trailer.

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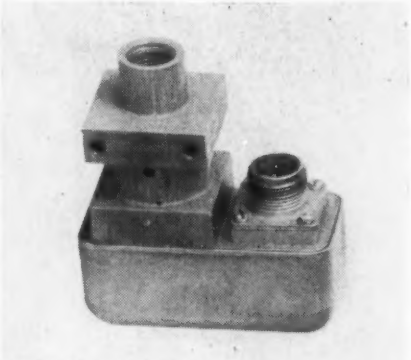

Pressure Switches

FOR AIR, fuel, gas and oil service, a new No. 9048 line of pressure switches is being manufactured by the Saval Co, 1915 East 51st St, Los Angeles 11, Calif. Designed to make or break an electrical contact in accordance with pre-set pres-

sures, it can be made to operate the full range of 100 to 5000 psi. Unit is said to compensate for temperature changes and maintains a constant setting from minus 50 to plus 150 F. Dimensions are: 4⅜x3 3/16x1½ in.

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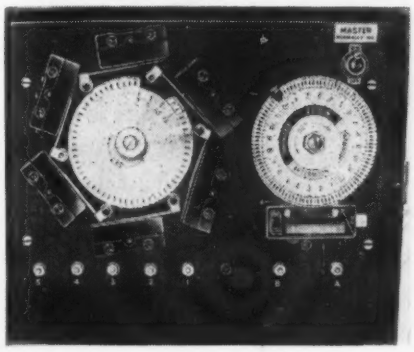

Sprinkler Switch

FOR USE with numerous types of overhead or concealed irrigation systems, a sprinkler switch has been developed by Tork Clock Co, Mount Vernon, N. Y. It turns sprinklers off and on at regular, timed intervals.

This new switch provides for multiple circuits operating in sequence for an adjustable period. Number of circuits available are from 2 to 20. A special master switch is provided to discontinue operation during rainy weather. Average sprinkling time is said to be from 12 to 15 min on each branch. The control is electrically operated and utilizes magnetic solenoid valves in the water pipe.

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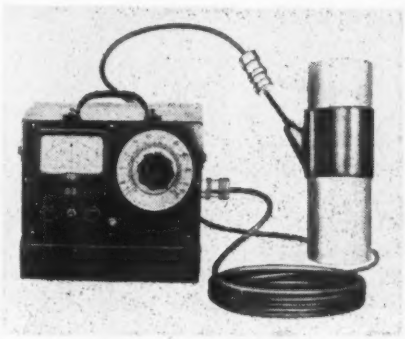


Weight Indicator

A DIRECT-READING, electronic weight indicator is available from Baker Oil Tools, Inc, P. O. Box 2274 Terminal Annex, Los Angeles 54, Calif. It is designed for measurement of an operation in which the tension load does not exceed 75 tons nor the compression load exceeds 150 tons. It is recommended for controlled setting of cement retainer, bridging plugs, fishing operations, etc. by rig operators or service crews.

The indicator operates on the null balance principle and translates electrical impulses from the connecting sub into precise weight readings. Subs are equipped with electronic strain gages and compensated for internal pressure.

Model 500A is now available, subs may be furnished in any size on special order. Standard sub is a 2½-in. double-box 8-thread round external upset unit.

•

MORE NEW PRODUCTS
about which you should know

Eastern Specialty Co, 3618 N. 8th St, Philadelphia 40, Pa. has developed the Tesco **rotary tap switch**, each switch section having 7 active positions and an off position and rated at 50 amp continuous duty with an over-load capacity of 75 amp . . . Ingersoll-Rand Co, Phillipsburg, N. J. is now producing both 9 and 20 hp **air motors** as starters for internal combustion engines . . . Davis Emergency Equipment Co, 45 Halleck St, Newark 4, N. J. has a Vapotester **indicator** for detecting combustible gases or vapors.

. . . Mechanical Industries Production Co, 217 Ash St, Akron 3, Ohio has developed a new line of "Mighty-Mite" **thermostats** with triple insulation barriers of compressed silicone fiberglass sleeving, faster thermal reaction, and higher temperature ratings . . . The Resinous Products and Chemical Co, 22 W. Washington Sq, Philadelphia 5, Pa. is now producing Amberlite IR-105, a new high-capacity synthetic resin **cation exchanger** in bead form . . . Engineering Research and Development Co, Hinsdale, Ill. has a new automatic **liquid balance** for determining by weight the flow of any liquid.

. . . Roller-Smith, Bethlehem, Pa announces a new Model 500 **volt-ohm milliammeter** with a wide selection of ranges . . . Speed Selector Inc, 118 Noble St, Cleveland 13, Ohio has a new 5 hp **variable speed drive** providing infinite ratio, split-second control of speeds from 0 to 800 rpm . . . Induction Heating Corp, 183 Wythe Ave, Brooklyn, N. Y. has produced a new Model M-800A electronic core **baking tunnel** with a capacity of 650 lb of cores per hour and an average baking cycle of only a few minutes . . . The Acro Electric Co, 1340 Superior Ave, Cleveland 14, Ohio announces a new open blade snap-action **switch** that carries a rating of 15 amp at 125v or 7½ amp at 250v a-c . . . Mechanical Products Corp, Dept EW, 168 Ogden Ave, Chicago, Ill. has developed a motor-driven **metering pump** that has a capacity of 10 cc per sec and is adaptable to a wide range of output.

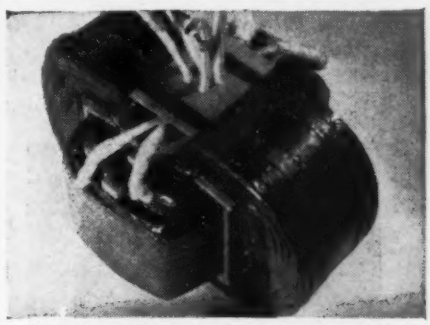
Silicone News

DC SILICONES

New Silicone Insulated 3 kva transformer

SAVES 35% IN WEIGHT

TAKES 15% MORE OVERLOAD



Core and coil assembly of DC Silicone insulated 3 kva distribution type transformer manufactured by Kuhlman Electric Co. of Bay City for Bureau of Ships, U.S. Navy.

Engineers of the Kuhlman Electric Company, working under contracts let by the Bureau of Ships, U.S.N., are using Dow Corning Silicone Insulation together with improved core steels to advance the design of dry type transformers. Size and weight of 3 kva distribution type transformers are greatly reduced without appreciable sacrifice of electrical characteristics. Core losses are actually reduced, regulation is practically unchanged as indicated by data given in the table below. These transformers also pass standard tests for dielectric strength, induced potential, and humidification.

Dow Corning Silicone Insulation offers electrical engineers unprecedented freedom in the design of similar dry type distribution or spot welding transformers as well as motors and generators. For more information write for pamphlet No. AB 23-1.

	Silicone Insulated	Class B Insulated
Weight in pounds (including steel case)	48	70
Volume, cubic inches	862	1020
Losses in watts		
core	31.4	41
total	136.4	105
Regulation in %		
100% Power Factor	3.53 (150°C. rise)	2.6 (80°C. rise)
80% Power Factor	4.35 (150°C. rise)	4.3 (80°C. rise)

DOW CORNING CORPORATION
MIDLAND, MICHIGAN

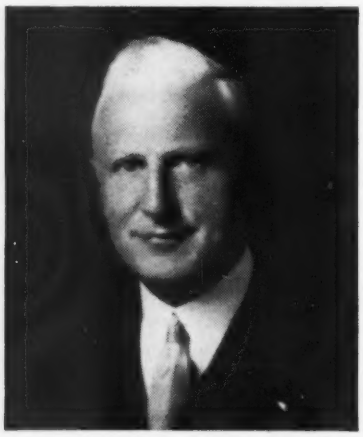
New York • Chicago • Cleveland • Los Angeles
Dallas • Atlanta
In Canada: Fiberglas Canada, Ltd., Toronto

Dow Corning
FIRST IN SILICONES

NEWS ABOUT PEOPLE

Harrison Made President, IT&T; Behn Chairman

Gen William H. Harrison has been elected president and a director of the International Telephone & Telegraph Corp, New York, effective September 1. Col Sosthenes Behn, chairman and president of IT&T, will



W. H. HARRISON

continue as chairman of the corporation and chief executive officer.

General Harrison's telephone career includes wide experience in manufacturing, engineering, operations and management. He will leave the position of vice-president in charge of operations and engineering of the American Telephone & Telegraph Co with a record of outstanding achievement.

He had a distinguished war record in the Offices of Production Management from 1941 to 1942 and subsequently as major general he acted as director of procurement, Army Service Forces, Washington, D. C. In recognition of his war service, he has been awarded the Distinguished Service Medal by the Government of the United States, was made a Commander of the Order of the British Empire by the British Government and an Officer of the Legion of Honor by France. Mr. Harrison's long record of active service in the American Institute of Electrical Engineers culminated in his election to the presidency in 1937. At a joint meeting of AIEE and the Institute of Radio Engineers in 1946 he received the 1945 Hoover Medal. The appointment of General Harrison will allow Colonel Behn to devote more time to the many pressing international problems of the corporation.

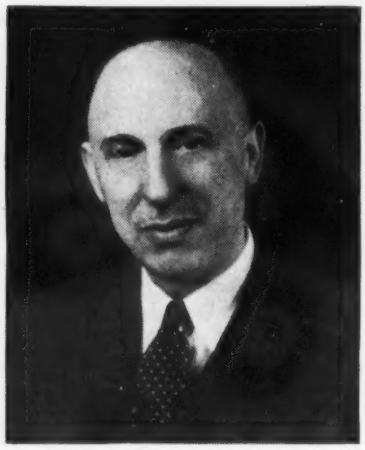
Gordon Kern, who has been associated with the IT&T System for more than 20 years, has been elected vice-president. He has had extensive experience in the communications and engineering fields and has travelled widely since joining the corporation.

•

J. H. Aiken Elected V-P of Consolidated Edison

John H. Aiken has been elected a vice-president of the Consolidated Edison Co of New York, Inc. Mr. Aiken will be in charge of the company's purchasing and stores, fuel and commercial buildings departments. Charles B. Delafield has been elected an assistant vice-president, public relations.

Mr Aiken joined the United Electric



J. H. AIKEN

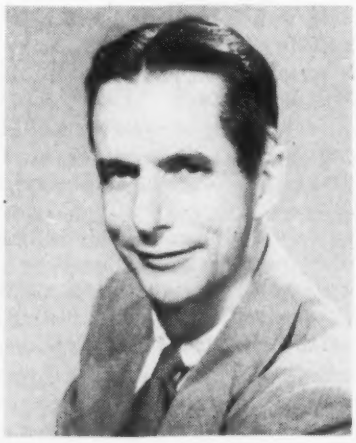
Light & Power Co, a predecessor of Consolidated Edison, in 1922 as a statistician. He became treasurer of the New York Edison Co, another predecessor, in 1934 and was made general commercial manager of Consolidated Edison in 1936. He received the title of assistant vice-president in 1938.

Mr Delafield is an assistant to President Ralph H. Tapscott and will retain that title. He joined Consolidated Edison in that capacity in 1946. Earlier he was engaged in financial work and was associated with Kidder, Peabody & Co. He became identified with the Illinois Power Co as assistant to the president in 1942 and later was made a vice-president.

L. R. Gaty of Philadelphia Assigned Broader Duties

Lewis R. Gaty has been appointed manager of the engineering department of the Philadelphia Electric Co, succeeding K. M. Irwin, who was recently elected vice-president in charge of engineering. (EW, May 28, page 143).

Mr Gaty has been identified with the utility industry since 1923, having served with the Pennsylvania Power & Light Co and the Sioux City Gas & Electric Co, Sioux City, Iowa, before entering in



L. R. GATY

1926 the employ of the Counties Gas & Electric Co at Norristown, later merged with Philadelphia Electric. Following a series of other assignments, each with increasing responsibilities, he was named assistant electric engineer of Philadelphia Electric in 1940. Since 1944 he has been serving in the capacity of electrical engineer.

A graduate of Cornell University in electrical engineering, Mr Gaty is president of the company's employees' association and a member of the American Institute of Electrical Engineers.

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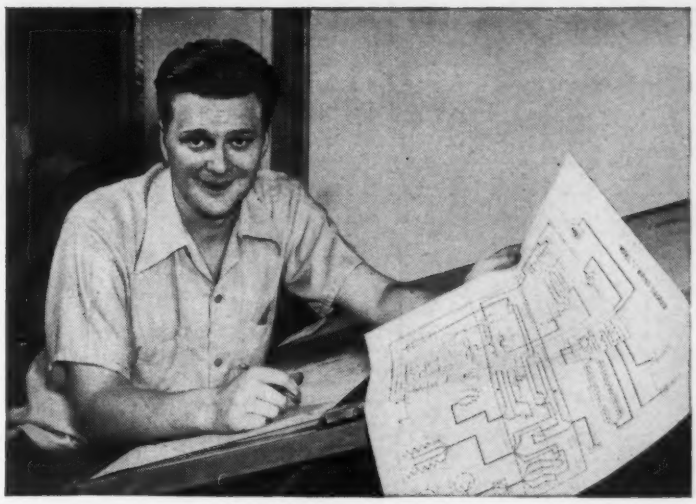
▶ Clyde O. Ruggles, professor of public utility management and regulation, Harvard Graduate School of Business Administration, retired from that position at the closing of the past term. He went to Cambridge in 1928 from the deanship of the School of Commerce and Administration, Ohio State University. Prof Ruggles served as director of research from 1940 to 1942. He has

A new future for your drawings!



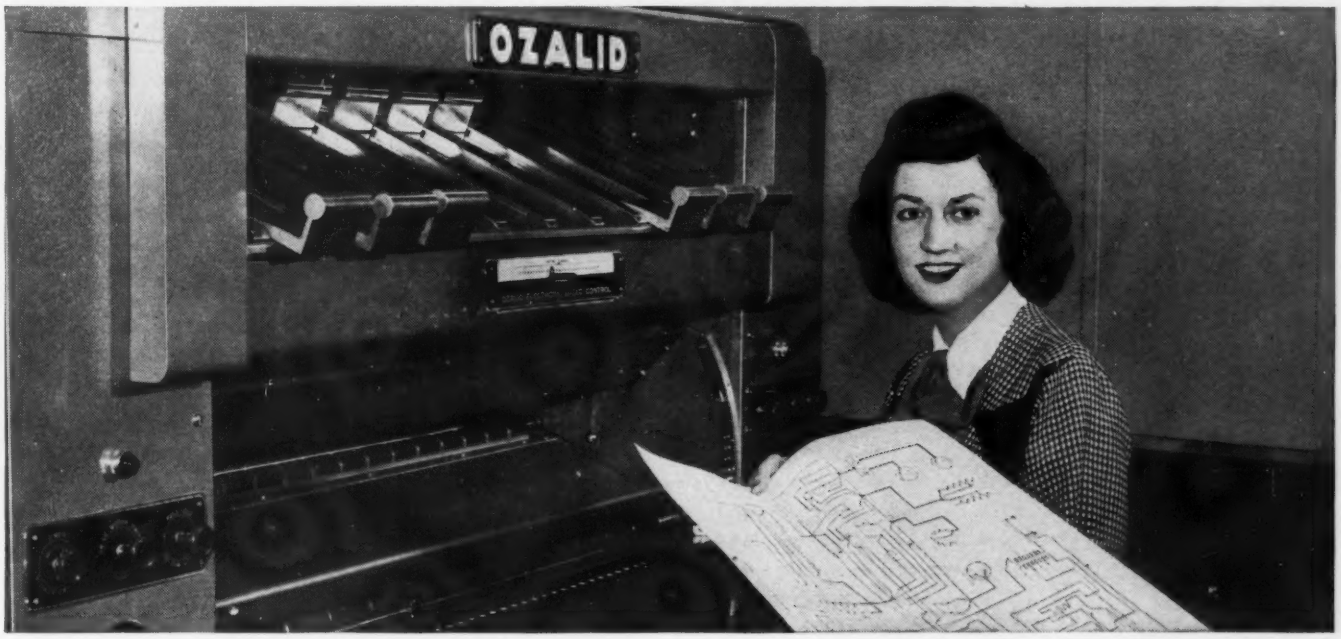
1. Now any of your drawings can be reproduced in black, blue, red, or sepia lines on white or tinted paper. Thus, you can "color code" your prints . . . speed routing . . . eliminate errors.

2. You can always match the job at hand. For example: If grease and grime abound in the shop you can practically eliminate replacements by ordering Ozaplastic prints. These durable prints are oilproof, waterproof—can be cleaned in seconds with a damp cloth.

3. You can improve on your best drawing by ordering Ozacloth or Ozalith translucent "masters." These new materials increase the line densities of your original . . . are plastic-coated . . . oilproof, waterproof . . . turn out Ozalid prints of maximum visual density.

4. New Ozalid Stripfilm—a transparent, adhesive-back material—can be used to transfer title blocks, sections, etc., from one drawing or master copy to another.

Using Ozalid foils, you can combine on *one* print the details of separate, but related, drawings. And new Ozachrome even allows you to make transparent overlays in full color.



Always the same simple operation—Exposure and Dry Development—to produce the desired type of Ozalid print.

And speed? Standard Ozalid prints are produced in 25 seconds—or less! Each a positive copy produced directly from your original drawing.

New Free Booklet!

See all the Ozalid prints you can make . . . and learn specifications of complete line of Ozalid machines. There's *one* for you.

OZALID A Division of General Aniline & Film Corporation
Johnson City, New York

DEPT. NO. 130

Gentlemen: Please send free booklet of Ozalid prints . . . and machine catalog for all printmaking requirements.

Name_____

Position_____

Company_____

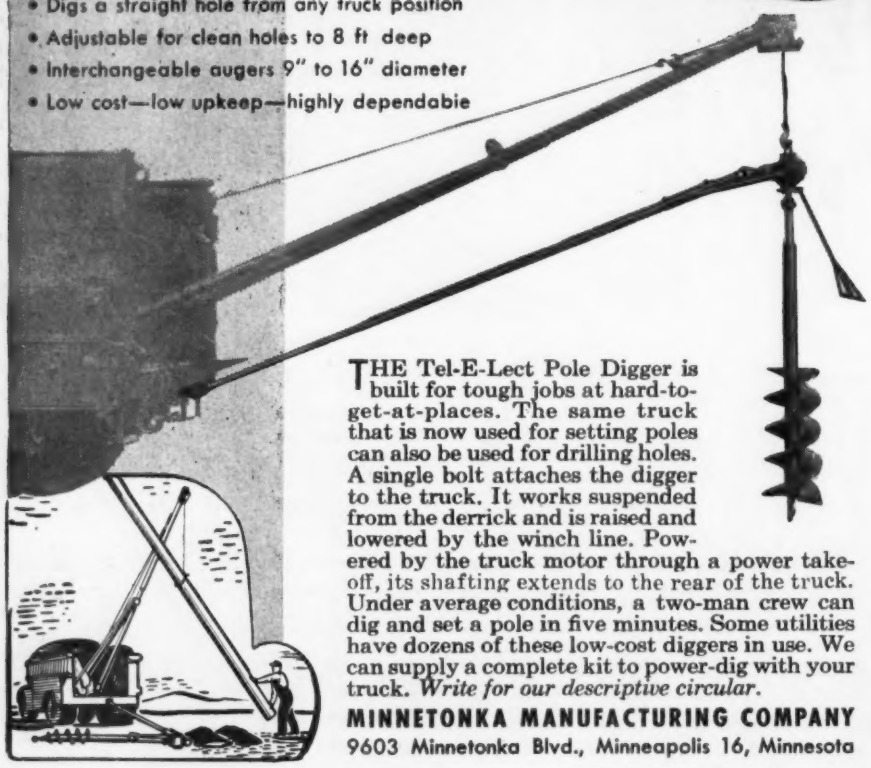
Address_____

Ozalid in Canada—Hughes Owens Co., Ltd., Montreal

DIG HOLES WITH YOUR LINE TRUCK AND CREW

TEL-E-LECT POLE HOLE DIGGER

- Digs a straight hole from any truck position
- Adjustable for clean holes to 8 ft deep
- Interchangeable augers 9" to 16" diameter
- Low cost—low upkeep—highly dependable



THE Tel-E-Lect Pole Digger is built for tough jobs at hard-to-get-at-places. The same truck that is now used for setting poles can also be used for drilling holes. A single bolt attaches the digger to the truck. It works suspended from the derrick and is raised and lowered by the winch line. Powered by the truck motor through a power take-off, its shafting extends to the rear of the truck. Under average conditions, a two-man crew can dig and set a pole in five minutes. Some utilities have dozens of these low-cost diggers in use. We can supply a complete kit to power-dig with your truck. *Write for our descriptive circular.*

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National offers more than insulation and service. *National knows how.* Through actual experience, the National Insulation Engineer knows how his material is manufactured—what it is designed to do—how it performs under the most difficult applications and how to use the insulation most efficiently in your plant.

National Insulation Engineers can offer production hints which often save time and money and make for better employee efficiency.

Use National Service. A complete source of electrical insulation materials. Delivery from large stocks.

You are protected by National's experience and National's extremely particular Inspection Department.

Send for a National Insulation Engineer—*today.*

NATIONAL ELECTRIC COIL COMPANY
COLUMBUS 16, OHIO, U. S. A.

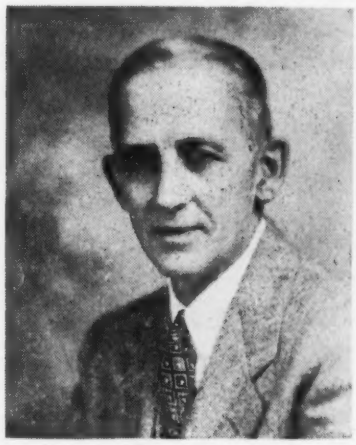
taught in summer at the University of Chicago. His research work includes studies of regulatory commissions, state and Federal, and many special public utility problems. Prof Ruggles is at present conducting a seminar on public control of public service industries at the (Harvard) Graduate School of Public Administration. He is also a member of a New England Council committee investigating the power resources of New England. His plans for the future include some instruction, research and consulting work.

•

Minnesota Power Appoints Two New Vice-Presidents

Election of B. A. McTeigue and C. H. Seipp as vice-presidents of Minnesota Power & Light Co, Duluth, has been announced.

Mr McTeigue has occupied various auditing positions with the company and



B. A. McTEIGUE

C. H. SEIPP

its predecessors since 1922. In 1936 he was made assistant treasurer and in 1946 secretary and treasurer.

Mr Seipp has been associated with the company and its predecessors since 1923 in various accounting positions and in 1946 became the company's chief

Here's the Closest Approach to Cable PERMANENCE that Man has Ever Seen

. . . and Here's Why ROCKBESTOS A. V. C. Lasts, and Lasts and L-a-s-t-s

Rockbestos A.V.C. is the cable that's *permanently insulated* with impregnated felted asbestos and covered with a tough impregnated asbestos braid.

Asbestos, one of the earliest minerals used by man, is today best known for its many fireproofing applications. It is incombustible, non-conducting and resistant to heat, chemicals, oils and greases. This "eternal" age-resisting fibre has also been found intact in ancient Egyptian tombs.

Rockbestos—alone—was first to recognize and adapt its permanent characteristics via special processing methods—to make the original "Cable with Permanent Insulation." Often copied, yet never successfully duplicated, Rockbestos A.V.C. even today remains alone in its field, far ahead of its followers. There is no "good substitute" for Rockbestos A.V.C. *at any price*.

Get your copy of the new No. 10-F Rockbestos Catalog, 96 pages sectioned for easy reference—write today—to our nearest district office or direct:

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NEW YORK CLEVELAND DETROIT CHICAGO
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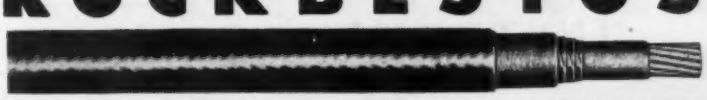
ROCKBESTOS



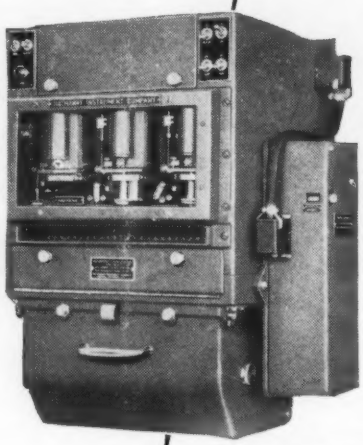
THE CABLE WITH PERMANENT INSULATION

Recorder of System Faults

The Type RS-9 Automatic Oscillograph waits indefinitely until a trouble occurs, then it is in full speed in 1-500 second, accurately recording cycle-by-cycle magnitudes, wave shapes, phase relations, short-circuit currents, relay and circuit-breaker operations.

No power transient is too fast for the RS-9. It will record the *first peak* values of current, voltage, or power!

- Twelve elements
- Galvanometers for current, voltage, or power
- 1 to 3 built-in starting relays
- Ten-inch chart
- Precision fine-line records
- Simple to adjust, service, and use



Hathaway Type RS-9
Twelve-element Recording
Oscillograph

FOR AUTOMATIC OR MANUAL OPERATION
FOR SWITCHBOARD OR PORTABLE MOUNTING

THE MOST VERSATILE OSCILLOGRAPH FOR THE CENTRAL-STATION ENGINEER

Write for Technical Bulletin SP-196G

Hathaway
INSTRUMENT COMPANY
1315 SO. CLARKSON STREET • DENVER 10, COLORADO

accounting officer when the position of comptroller was created.

•

▶ LOUIS S. DANKO has been appointed sales manager of the special products department of the Acme Electric Corp, Cuba, N. Y. Mr Danko became associated with Acme Electric following graduation from the Case School of Applied Science in 1934.

OBITUARY

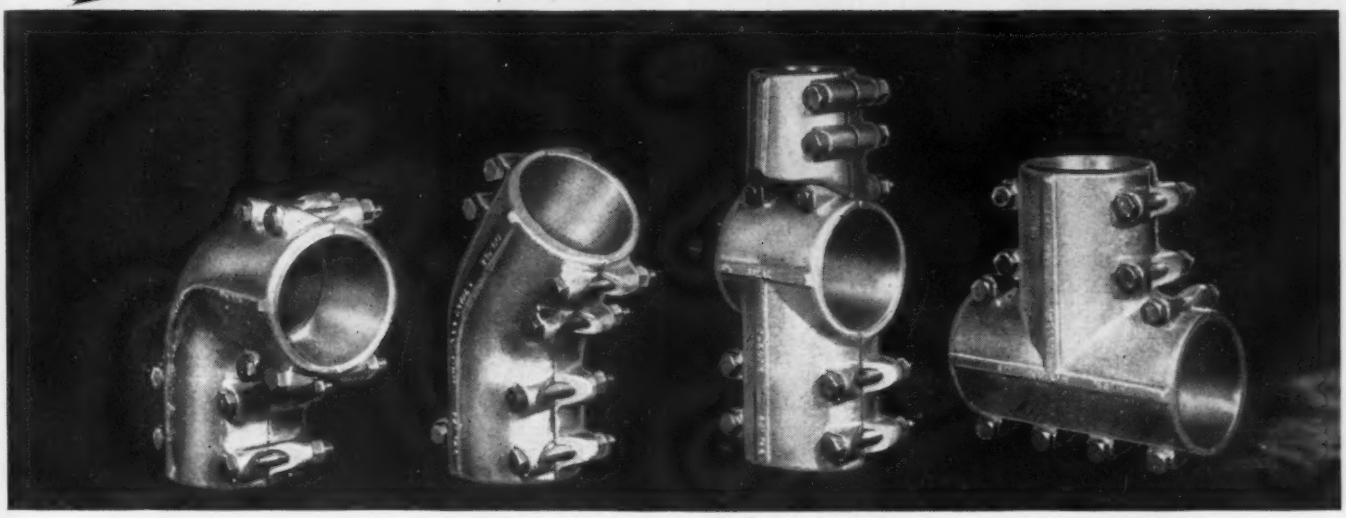
George O. Muhlfeld

George O. Muhlfeld, vice-chairman of the board of Stone & Webster, Inc, New York, died on July 8 at his home in Englewood, N. J., after a long illness. He was 72 years old. During the 47 years he was connected with the company, Mr Muhlfeld supervised the design and construction of many outstanding hydroelectric projects in this country and abroad, steam station developments for the utility industry and a large volume of industrial work for leading manufacturers. The range of Stone & Webster's many undertakings carried Mr Muhlfeld into the financial and banking field, where he was instrumental or intimately associated with the formation of important public utility companies, banking and security corporations.

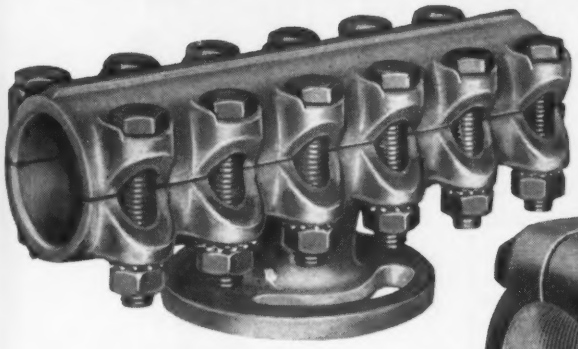
After studying engineering at Purdue and Cornell, Mr Muhlfeld entered upon the first step of his business career as a contractor in Peru, Ind., his native city, in 1895. It was not long before he was active in construction work in fields far from home and the year 1901 found him in the Northwest as an employee of Stone & Webster on one of their earlier hydroelectric developments. He served successively as surveyor, foreman, superintendent, construction manager, vice-president and president of the Stone & Webster Engineering Corp.,

POWER CONNECTORS

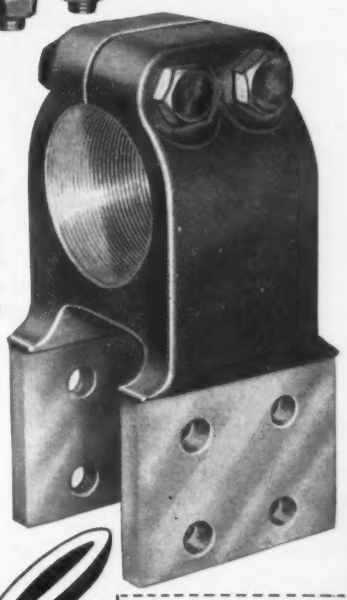
FOR ALL UTILITY AND INDUSTRIAL S-P-E-C-I-F-I-C-A-T-I-O-N-S



These four tubular bus fittings were chosen by one of the largest manufacturers of electrical equipment for use with a 3000 test bus. The fittings are Type RE-90 and 45 degree elbows; Special Type MF cross connector; Type MC tee coupler. All contact surfaces were silver plated after precision machining.



This is a specially designed Type RSC Bus Support Coupler. It is furnished with 12—½" everdur machine bolts to provide positive electrical coupling and additional mechanical support for long spans of tubular bus. The standard 8 bolt designs are listed on page 81 of Catalog 11. The design illustrated is Dwg. 4693A.



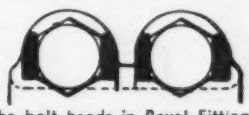
A Special Type RF stud connector for 3½" threaded stud. Supplied to a builder of oil circuit breakers to meet a particular arrangement of flat bus. Royal facilities are perfectly suited to meet these exacting requirements. This is Dwg. 4904-A.

Our large catalog No. 11 with its hundreds of POWER CONNECTORS, should contain the exact types you require. If not, ROYAL development and production engineers, cooperating with you, can provide the answer. The POWER CONNECTORS featured here are examples of our ability to design for specific needs. The famous ROYAL Socket permits installation with one wrench and the use of standard hexhead bolts.

HUSKY BOLTS . . . Royal Connectors are furnished with ½" clamping bolts for ½" SPS tubing and larger, and for 500 MCM cable and larger.

Meets Important Standard . . .
Laboratory tests indicate that the resistance of a CONNECTOR SPLICED section of wire should be less than the equivalent length of wire. ROYAL POWER CONNECTORS meet this standard.

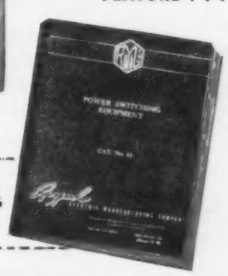
EXCLUSIVE FEATURE . . .



The bolt heads in Royal Fittings are prevented from turning. One casting is provided with ears which nest the bolt head. This permits the use of standard hex head bolts, readily obtained anywhere. The entering and leaving edges of these fittings are throated. This results in a dampening effect on conductor vibration and eliminates any possible hard spot or localized stress.

SPECIALISTS IN SPECIAL EQUIPMENT

Royal



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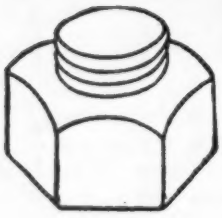
Trademark

LOCKNUTS

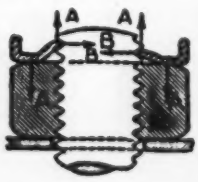
—and save cost, too!



THIS ORDINARY ASSEMBLY, consisting of bolt and regular nut, can be kept absolutely tight in service.

. . . WITH THE ADDITION OF A PALNUT LOCKNUT which spins on easily on top of regular nut and

. . . BECOMES A VIBRATION - PROOF ASSEMBLY when the Palnut is tightened with 1/3 turn of a wrench. Double-locking action* keeps bolt and nut secure.



* **Double-locking action**

Arched, slotted jaws grip the bolt like a chuck (B-B), while spring tension is exerted upward on the bolt threads and downward on the regular nut (A-A), securely locking both.

● PALNUTS are available in full range of sizes, in plain, parkerized, cadmium and hot dip galvanized finishes. Send for samples and literature.

The PALNUT Co.

81 COSDEN ST IRVINGTON 11 N

and vice-president and president of Stone & Webster, Inc. It was in 1945 that he became vice-chairman. He was a director of the Stone & Webster Service Corp, in addition to being a director and member of the executive committee of the parent company.

•

► HARRY DIAMOND, chief of the electronics division of the National Bureau of Standards, died on June 21 at his home in Washington, D. C. He was 48 years old. Mr Diamond was one of the chief developers of the proximity fuse for shells, which was one of the most important ordnance discoveries of World War II. Born in Quincy, Mass, Mr Diamond worked for several industrial companies in and near Boston before joining the Bureau of Standards staff in 1927. His activities included aviation radio, radio meteorological observation, radio direction finding, electronic ordnances and electronics. He also organized the first radio course at Lehigh University, where he was an instructor in electrical engineering from 1923 to 1927. Mr Diamond received the Washington Academy of Sciences award for engineering achievement, 1940; the Naval Ordnance Development Award for exceptional services, 1945, and a War Department certificate for outstanding service, 1945. He was a fellow of the American Institute of Electrical Engineers and the Institute of Radio Engineers and a member of other scientific societies.

► ELMER G. BIECHLER, formerly president of the Frigidaire Corp and the Delco Light Co, died on July 5 at Dayton, Ohio, at the age of 58. Mr Biechler was general manager and president of Delco from 1924 to 1926, when he became president and general manager of Frigidaire. The two companies are divisions of General Motors Corp. Mr Biechler retired as head of Frigidaire in 1943 because of poor health.

► RUSSELL GRINNELL, chairman of the board of the Grinnell Corp, Providence, R. I., died on July 2 at his summer home in Exeter, R. I. He was 72 years old. Mr Grinnell had been president of Grinnell Corp, which was founded by his father, the late Frederick Grinnell, from 1925 until last April, when he resigned to become chairman of the board. At the time of his death he was serving as second vice-president of the National Fire Protection Association.

► W. C. KNAPP, manager of the Western Electric Co's Portland (Ore.) branch, died in San Francisco on July 8 of a heart attack. He was 54 years old. Mr Knapp had been identified with Western Electric for 38 years.

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SUPERIOR SWITCHBOARD & DEVICES CO.

CANTON 1, OHIO

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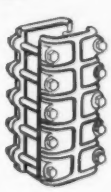
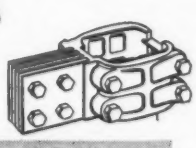
MAKE CONNECTIONS THREE WAYS

...with Chase Square Bus Conductors!

1 CLAMP TYPE JOINTS



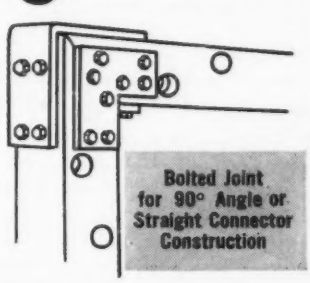
Straight Connector Tube to Tube



Tee Connector Tube to Bar

Tee Connector Tube to Tube

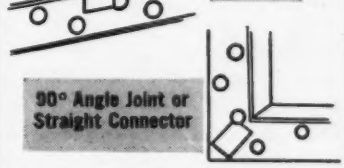
2 BOLTED JOINTS



Bolted Joint for 90° Angle or Straight Connector Construction

3 BRAZED JOINTS

Tee Joint



90° Angle Joint or Straight Connector

THREE different types of connections can be used on installations of Chase Square Copper Bus Conductors—clamping, bolting or brazing. In addition, the four flat sides permit adequate and uniform pressure to be exerted between the large contact surfaces, resulting in firm, secure joints.

For information on other advantages of Chase Square Copper Bus Conductors, ventilated and unventilated, send for our new illustrated booklet to Dept. EW78.

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MANUFACTURERS and MARKETS

ENGINEERS hear James M. Whittenton, sales manager of General Electric Co's Electric Instrument Sales Division, state that panels in background were designed to inform better industrial leaders on "just what makes meters tick and how that ticking will make for better quality and cost control" The speech was made in connection with Chicago exhibit which attracted many utility engineers

GE 'Instruments in Industry' Exhibit Starts Nationwide Tour in Chicago

A TRAVELING EDUCATIONAL EXHIBIT which might well be entitled "Instruments in Industry" is now on a nationwide tour. Sponsored by the Meter and Instrument Division, General Electric Co, West Lynn Works, the exhibit has for its basic purpose the education of industrial management and engineers on instrumentation and how measuring devices can be advantageously applied to industry.

Bookings will take the exhibit into every primary and secondary manufacturing center in the nation. In Chicago last week, it was viewed by more than 100 utility and industrial specialists and their manufacturing customers. This initial showing was a general, horizontal program. Others tailored to the needs of specific industries, such as steel, transportation, and food processing were to follow later in the week.

The initial Chicago program included a talk by J. M. Whittenton, sales manager, Electric Instrument Sales Division, on the subject "What Can Instruments Do For Industry". Whittendon stated that plant engineers and managers now more than ever before need more specific and more precise data to properly control operations and costs. Industry can benefit by instrumentation as much as utilities already have if the now available tools and techniques are properly applied.

Referring to the 18 panels set up around the room, he emphasized that instrument manufacturers are now able to provide the tools with which many conditions may be measured—such as electrical conditions, mechanical movement, position of remote objects, speed, and temperature. These results, he emphasized, can be indicated, recorded, or telemetered to a central point for better control of plant or department operations.

The exhibit is composed of over 150 typical instruments. These devices and photographs are mounted on 18 panels, size 30 x 40 in., and were erected on 60 ft of display tables. It is self contained with panel light, table and panel draperies, stage accessories with projectors, screen, lectern, and portable public address system.

Supplementing the exhibit are nearly 200 kodachrome slides of instruments and their application. The complete exhibit is packed in especially built shock-absorbing cases and will be transported in a one and a half ton truck.

Apex Electrical Purchases Lake State Products

Apex Electrical Manufacturing Co, Cleveland, has purchased all of the capital stock of Lake State Products, Inc, Jackson, Mich., producers of electric dishwashers and portable clothes washers.

C. G. Frantz, Apex president, said the acquisition calls for an initial investment of close to $500,000. The Lake State Products plant at Jackson will be kept in operation as a wholly-owned subsidiary of Apex, Mr Frantz stated. The plant, he said, has a capacity of 50,000 automatic dishwashers per year and production will be geared to expected requirements as rapidly as possible. No change in present plant personnel is contemplated.

•

Westinghouse Will Increase Transformer Production

Westinghouse Electric Corp will boost production of large power transformers by building a 92,000-sq ft addition to its Sharon plant, John K. Hodnette, vice-president and manager of the company's transformer division, has announced. Ground has already been broken for a new shop in which the transformer tanks will be fabricated. Approximately 400 additional workers

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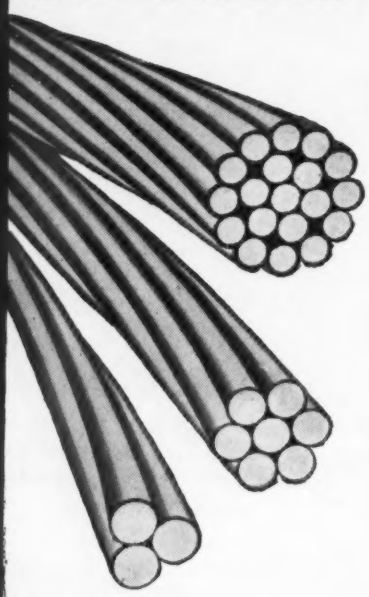
Stainless Steel

STRAND



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in Corrosion Resistance
Tensile Strength
Elastic Limit
Resistance to Vibration
Strength to Weight Ratio

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will be needed when the building is completed sometime after the first of next year, bringing the total employment at the Sharon works to more than 8,000.

Demand for power transformers today is more than six times as great as the average for the pre-war years. The new addition will bring Westinghouse production of power transformers to an all-time high level.

In addition to the new shop for tank fabrication, the Sharon expansion also calls for new equipment elsewhere in the works. New machinery for testing, coil winding and treating facilities, and equipment for fabricating silicon transformer core steel will be installed.

•

Wages and Prices Keep Going Up in Last Week

Wages and prices in the electrical industry continued upwards last week. Emerson Electric Manufacturing Co gave hourly increases of 9 to 16 cents to 4,200 production employees. The increases are retroactive to April 1. The United Electrical, Radio & Machine Workers, CIO, was the bargaining agent.

Westinghouse Electric Corp announced an increase in appliance prices. Based on Jan 1 prices, the average retail prices of ranges are up 7.1%; refrigerators, 5.7%; water heaters, 3.3%; and small appliances, 4.9%.

Locke, Inc, raised the price of pole line hardware 10%.

Revere Copper & Brass, Inc, advanced the price of copper and copper alloy mill products about 5%.

Landers, Frary & Clark raised the prices of most of its line of Universal Household Appliances an undisclosed amount. Because of promotional campaigns, no change was made in price of automatic electric irons, heating pads, or hot plates. The price of its double-bed size electric blanket was reduced $2.

•

Water System Booklet

"Running Water, the Farm Necessity" is the title of a new promotional booklet issued by the Electric Water Systems Council. The booklet is a continuation of the Council's effort to keep the farmers aware of the advantages of running water under pressure. The simply written text shows the advantages of a water system to a farmer and shows him how to plan a system suited to his own needs. Copies of the booklet may be secured from the Plumbing and Heating Industries Bureau, 35 E Wacker Drive, Chicago 1, Ill.

STOP SEASON CRACKING AND CORROSION

with
HARPER
SILICON
BRONZE
fastenings

Power companies throughout America are using Harper silicon bronze fastenings to help avoid power failures . . . and to end maintenance and replacement costs. These fastenings withstand extremes of temperatures . . . season cracking . . . atmospheric and other corrosion . . . in both overhead and underground construction . . . and now that modern treating has increased pole life so greatly, there are added savings in using fastenings that do not have to be replaced.

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. . . of nonferrous and stainless fastenings for immediate shipment . . . brass, bronze, copper, Monel metal and stainless steel bolts, nuts, screws, washers, rivets, nails. Many items are rare and hard to get . . . not stocked elsewhere. Write for the Harper catalog.

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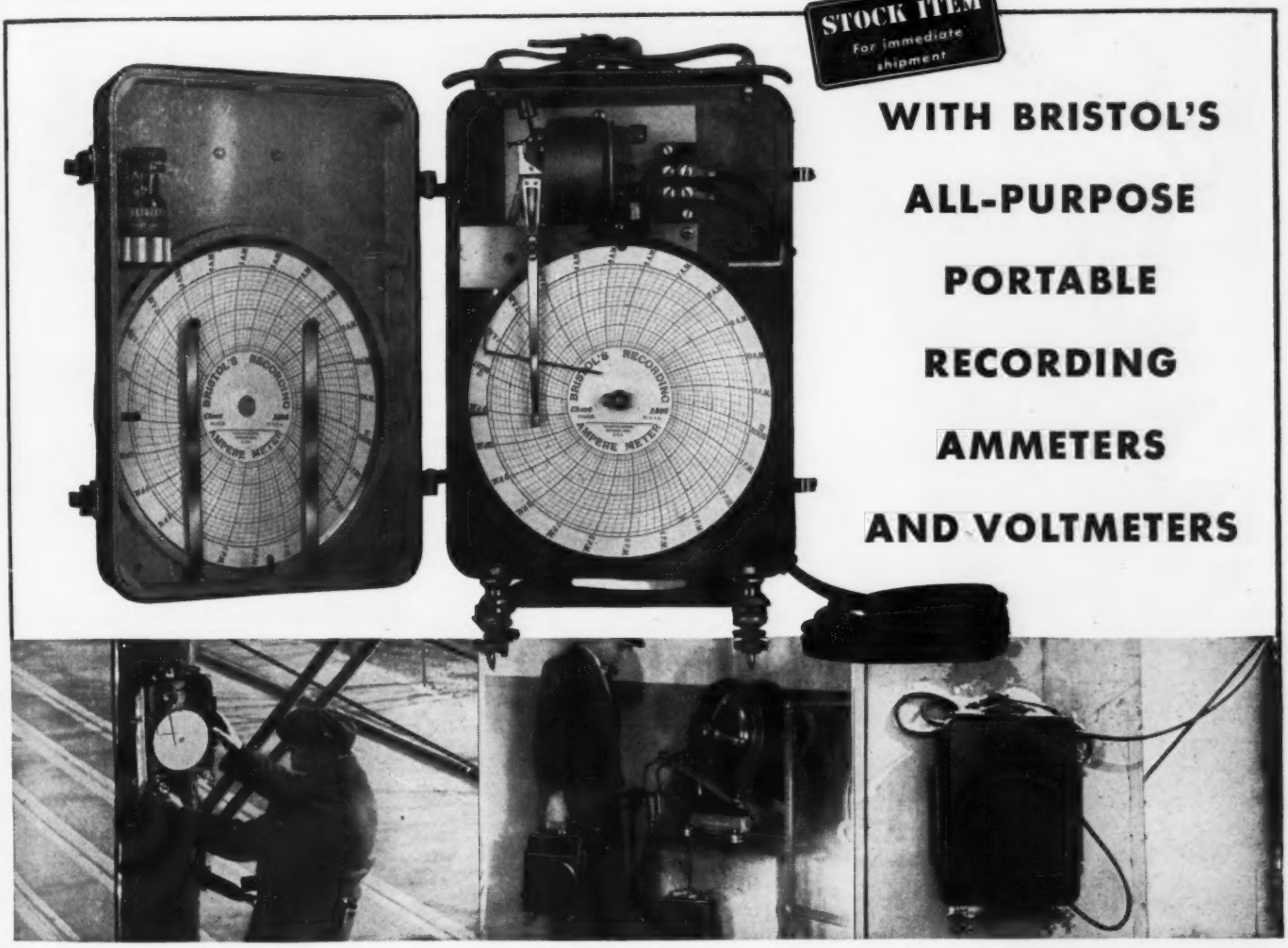

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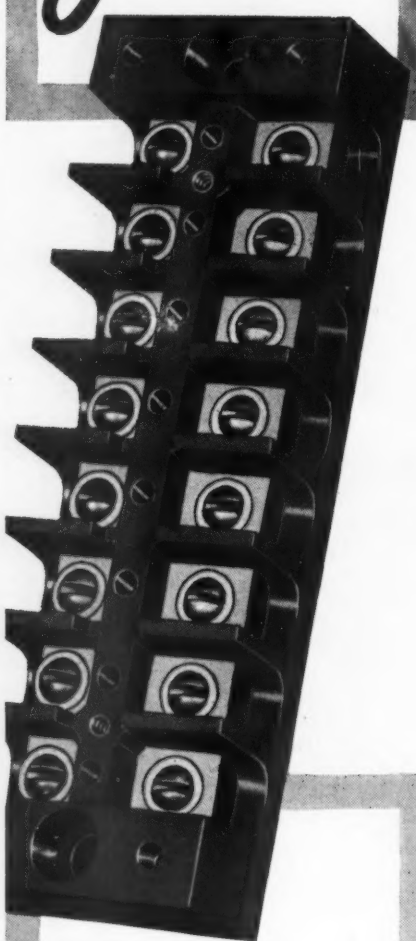

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RECENT RATE CHANGES

Associated Electric Co's proposal concerning the indebtedness owing it by its wholly-owned subsidiary, the Manila Electric Co, has been approved. Under the plan, all Manila's indebtedness at Dec 31, 1947 (including interest thereon to that date), will be subordinated to such promissory notes as Manila Electric may issue and sell prior to Dec 31, 1949, in amounts aggregating not in excess of P 4,800,000 ($2,400,000 at the current rate of exchange of two pesos to the dollar). As at Dec 31, 1947, Manila Electric had outstanding 97,220 shares of $50 par value common stock, having an aggregate par value of $4,861,000, an open account payable in the amount of $12,646,260, and $161,491 of accrued interest payable on the open account. All the shares of common stock and the open account payable are held by Associated Electric. The promissory notes, which will mature 30 months after date of issuance, or on Dec 1, 1951, whichever date shall be earlier, will be sold to four commercial banks in the Philippine Islands. (Release No. 8290).

Central Maine Power Co, a subsidiary of the New England Public Service Co, has received permission to increase its short-term debt to a maximum of $9,500,000. Central Maine proposes to borrow additional sums from the First National Bank of Boston to finance construction. (Release No. 8304).

Republic Light, Heat & Power Co, Inc, a subsidiary of Cities Service Co, has been authorized to borrow $1,500,000 from the Manufacturers & Traders Trust Co on 3% installment promissory notes payable in 36 quarterly installments beginning July 1, 1949, and ending April 1, 1958. Proceeds are to be used to repay $800,000 of outstanding notes and for construction. (Release No. 8308).

Central Massachusetts Electric Co has been permitted to sell to its parent, New England Electric System, 11,000 shares of additional capital stock at its par value of $100 per share. Proceeds will be used to pay off $700,000 of bank indebtedness and a $400,000 loan from New England. (Release No. 8309).

New Jersey Power & Light Co has received permission to offer at competitive bidding $6,000,000 of first mortgage bonds, due 1978. The terms of the offering are to be filed by amendment. (Release No. 8311).

United Corp has been authorized to tender to Public Service Corp of New Jersey 1,542,318 shares of Public Service's common stock in exchange for 1,542,318 share of common stock of Public Service Electric & Gas Corp and 154,231 8/10 shares of South Jersey Gas Co common stock. (Release No. 8312).

United Light & Railways Co has been authorized to purchase 37,500 additional shares of common stock of Continental Gas & Electric Corp, a subsidiary. The purchase price will be $40 a share. The $1,500,000 will offset a similar amount expended by the latter company in the recent purchase of 150,000 shares of additional capital stock of Iowa Power & Light Co, a subsidiary. (Release No. 8316).

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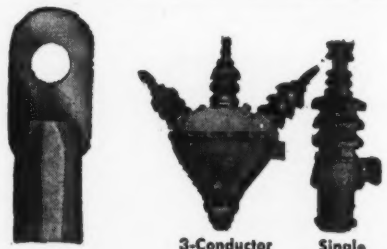

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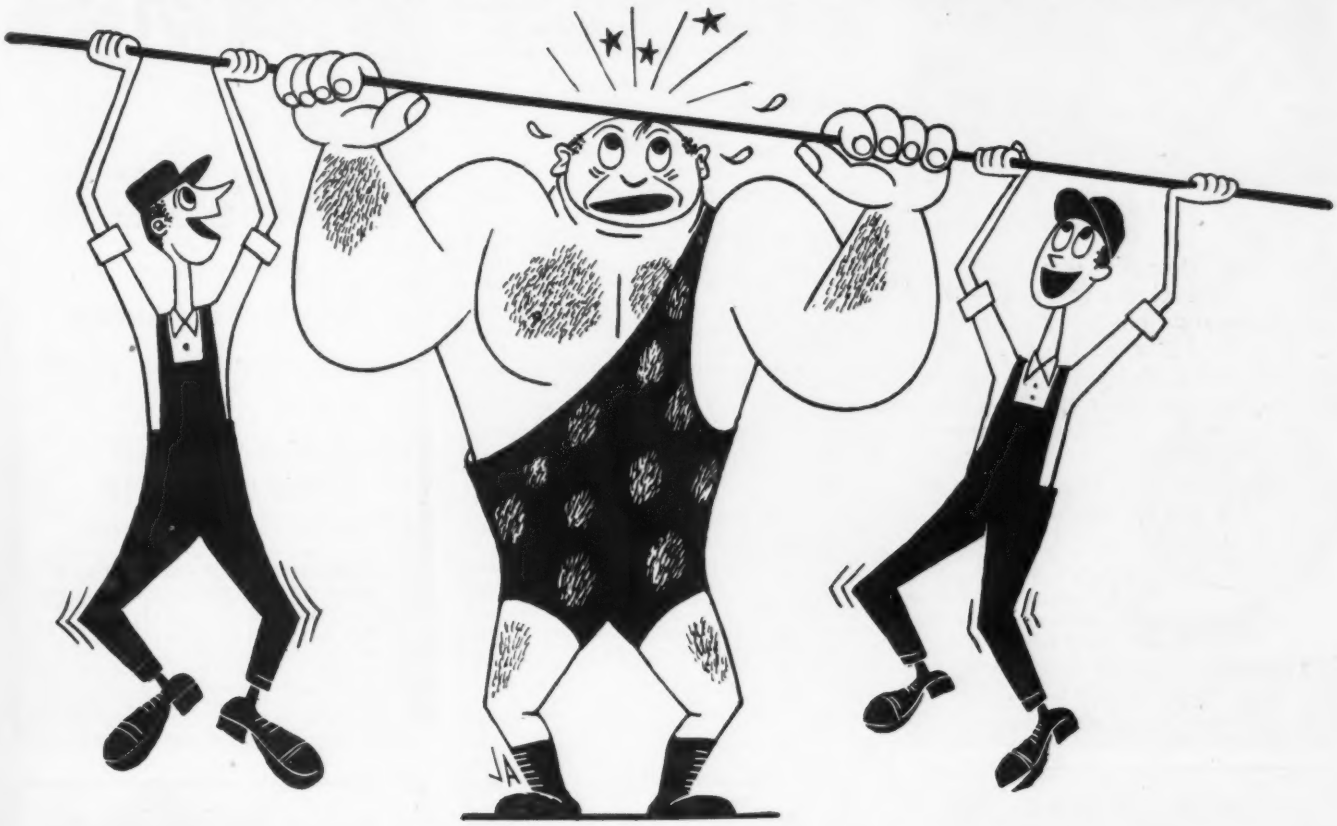

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NEW ELECTRICAL CONSTRUCTION

NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included

UTILITIES

Proposed Construction

Alabama—Black Warrior Electric Membership Corp., Demopolis, 482 mi. rural distr. lines, sys. imprvs., incl. 60 mi. new tie line, headquarters facilities, Greene Co. **$1,405,000.**

Arkansas — Ashley-Chicot Electric Cooperative Hamburg, 374 mi. rural distr. lines, Ashley Co. **$570,000.**

Calif., Sacramento—Sacramento Municipal Utility Dist., 59 and R Sts., plans by Herbert Goodpastor. Mitau Bldg., municipal utility plant. **$500,000.**

Florida—Talquin Electric Co-operative Corp., Quincy, 782 mi. rural distr. lines and sys. imprvs., Gadsden Co. **$1,400,000.**

Ill., Springfield—City, 20,000 kw. turbine generator and condenser for municipal light plant, $800,000. Burns & McDonnell, 95 and Troost Ave., P. O. Box 7088, Kansas City, Mo., engr.

Indiana—Whitley County Rural Electric Membership Corp., Columbia City, 50 mi. rural distr. lines, sys. imprvs., incl. 14 mi. new tie line, completing previous construction, Whitley Co. **$165,000.**

Iowa—Southwestern Federated Power Co-operative, Creston, 151 mi. rural distr. lines, purchase, installing 15,000 kw. steam plant, two 7,500 kw. units, and related substation facilities, Union Co. **$4,125,000.**

Iowa—Glidden Rural Electric Co-operative, Glidden, purchasing, installing two 1,160 kw. diesel generating units, sys. imprvs., headquarters facilities, 45 mi. rural distr. lines, Carroll Co. **$855,000.**

Louisiana—Valley Electric Membership Corp., Natchitoches, 268 mi. rural distr. lines, sys. imprvs., incl. 28 mi. transmission lines, headquarters facilities, Grant Co. **$680,000.**

Maryland—Southern Maryland Electric Co-operatives, Hughesville, 150 mi. rural distr. lines, sys. imprvs., incl. 25 mi. transmission lines and cable, 2 mi. new 3-phase tie line, etc. St. Marys Co. **$970,000.**

Mo., Columbia—University of Missouri, c/o The Curators, secy., Jesse Hall, underground electric distr. sys.

Montana — Bureau Reclamation, Dpt. Interior, Billings, one 500 kva. and three 5 kva. transformers, six 15,000 volt disconnecting fuses, three 12,470 volt lightning arresters, 2,300 volt motor control switchgear, one distr. panel board, etc., for Savage Pumping Plant, Missouri Basin Proj., Spec. R6-9 (Region 6). Walker R. Young, Denver, Colo., ch. engr.

Nebraska—Loup Valley Rural Electric Membership Assn., Ord, labor only, 359.64 mi. rural distr. lines, Garfield Greeley, Sherman and Valley Counties, $100,000. Raymond H. Reed & Co., Columbus, engr.

North Carolina — Tri-County Electric Membership Corp., Goldsboro, 204 mi. rural distr. lines, sys. imprvs., incl. 8 mi. single and 3 phase tie line, headquarters facilities, completing previously approved construction, Wayne Co. **$550,000.**

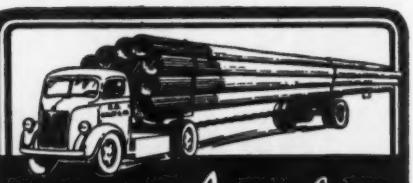
Ohio—Buckeye Rural Electric Co-operative, Gallipolis, 175 mi. rural distr. lines, sys. imprv., incl. 20 mi. transmission lines, 8 mi. tie line and completing previously approved construction, Gallia Co. **$700,000.**

Oregon—Benton-Lincoln Electric Co-operative, Corvallis. 97 mi. rural distr. lines, sys. imprv. and completing previously approved construction, Lincoln Co. **$525,000.**

Tennesssee—Mountain Electric Co-operative, Mountain City, 100 mi. rural distr. lines, sys. imprvs., headquarters facilities, completing previously approved construction, Johnson Co. **$635,000**

Texas—Swisher County Electric Co-operative, Tulia, rural distr. lines, Swisher Co. **$380,000.**

Wisconsin—Dunn Co. Elec. Co-operative, Menomonie, 266 mi. rural distr. lines and completed construction with prior REA approval, consisting 24 mi. distr. line, Dunn Co. **$452,000.**



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Low Bidders & Contracts Awarded

Calif., Los Angeles—City, Bd. P. Wks., 153 City Hall, reconversion electrolier lighting sys., Crenshaw Blvd. and 43 Pl. Lighting Dist., to Newberry Electric Corp., 1038 Venice Blvd., **$72,709.** Awarded 6/23.

Colorado—Bureau Reclamation, Dpt. Interior, Bldg. 1A, Denver Federal Center, Denver, June 9, Brush Yuma 69 transmission line, Colorado-Big Thompson Proj. Spec. 2229, from Townsend Electric Co., Inc., Jackson, Tenn., $318,144.

Georgia—Forsyth Co. Electric Membership Corp., Cumming, 336 mi. rural distr. lines in Forsyth, Gwinnett, Fulton, Cherokee, Dawson, Lumpkin and Hall Counties, to Trans-Electric Co., 106 E. Broadway, Louisville, Ky., **$391,476.** Bids 6/21.

Ill., Chicago—City, Dpt. Purchases, Contracts, & Supplies, City Hall, July 1, signal and interlocking equip. Contr. T-10, from Union Switch & Signal Co., 122 S. Michigan Ave., **$514,750;** circuit breakers, disconnecting switches, panels, resistors, Contr. T-13A, from I.T.E. Circuit Breaker Co., 333 N. Michigan Ave., **$67,480.** Received no bids supervisory control equip. Contr. T-13B, all for Dearborn St. subway.

Kansas—Flint Hills Rural Electric Co., Council Grove, 254.77 mi. rural distr. lines, 4.80 mi. conversion line, Chase, Marion, McPherson and Morris Counties, force labor, **$250,000.** Frank Horton & Co., Lamar, Mo., engrs.

Pa., Chester—Phila. Electric Co., 900 Sansom St., meter house, to Haverstick-Borthwick 1505 Race St., Phila., **$75,000.** United Engineers & Constructors, Inc., 1501 Arch St., Phila., engr.

Pa., Pennhurst (P. O. Spring City)—Pa. Dpt. Property & Supplies, 18 and Herr Sts., Harrisburg, general contract substation, electric service and distr. lines on one contract; electrical constr. for electric service and distr. sys., alterations and addns. on another contract, at Pennhurst State School.$440,000. Plans deposit $10 each contract. Frederick H. Dechant, 123 S. Broad St., Phila., engr.

Tex., Corpus Christi—Central Power & Light Co., 120 N. Chapparal St., superstructure 6 story, 70x152 ft. for electric power plant, concrete duct, screen house, piping to bring salt water to steam condenser, water supply structures to A. E. Hinman, Wilson Bldg. Approx. **$460,000.**

Washington—Bonneville Power Admin., P. O. Box 3537, Portland, Ore., materials for Midway-Hanford sect. of Midway-Benton transmission line, to American Bridge Co., Frick Bldg., Pittsburgh, Pa. **$111,504.**

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS.

Proposed Construction

Minn., Minneapolis—Minneapolis Jewish Hospital Assn., M. Elbin, vice-pres. 450 Builders Exchange Bldg., 6 story, bsmnt., penthouse 200-bed hospital, 22 St. and Chicago Ave. $2,500,000. Schmidt, Garden & Erikson, 104 S. Michigan Ave., Chicago, Ill., and Libenberg & Kaplaan, 51 S. 13 St., archts.

Tex., San Antonio—Escuela de Medicina de San Antonio, c/o Dr. Urrutia, Broadway, School of Medicine. **$3,500,000.**

Low Bidders & Contracts Awarded

Ill., Springfield—State, Springfield, June 22, general contract coliseum bldg., from W. E. O'Neil Constr. Co., 2751 Clybourn Ave., Chicago, **$2,594,000*****general contract exposition bldg., from Lloyds Builders, 61 West Superior St., Chicago, Ill., **$887,447*****general contract combination coliseum and exposition bldg. all at State Fairgrounds, from S. N. Nielsen, 3059 Augusta Blvd., Chicago, **$3,360,000.**

N. M., Albuquerque—U. S. Eng., Albuquerque, 50-bed 3 story, 97x195 ft. hospital, to Robert E. McKee, P. O. Box 651, El Paso, Tex. **$1,799,000.** Bids 6/3.

N. Y., Brooklyn—Bd. Transportation, 250 Hudson St., New York, Zone 13, general construction, garage, shops and storehouse for each New York bus depot, Ranchon Pl. and Jamaica Ave., to Pstay & Furhman, Inc., 369 Lexington Ave., New York, Zone 17, **$5,444,353.**

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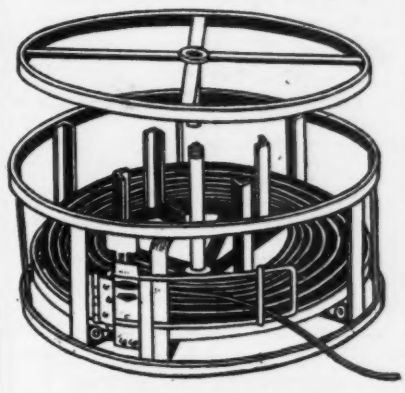

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Starting of Room Coolers

(*Continued from page 74*)

ondary. Unfortunately every customer on the secondary sees all or some part of every flicker from every start of every air conditioner.

Thus the future importance of room air conditioner as a starting flicker problem on distribution systems depends on two factors: (1) the intention of air conditioning industry to develop the room cooler market and (2) the use of manual or automatic control on the units produced.

Looking to the future it appears the utility industry can look forward to a very considerable increase in the number of room air conditioners on their systems. These units will be mostly manually controlled and mostly located in areas of relatively light load density.

The low starting frequency of individual units in the Philadelphia tests should continue to be the experience. If this proves to be the case, saturation can increase until several units appear on the same secondary and combined starting frequency of all of them as a group causes a serious flicker complaint.

It is believed that the general answer to the question of power supply to room air conditions in residential areas lies in the joint work already done by EEI and the Air Conditioning and Refrigerating Machinery Association, wherein:—

1—EEI recommended to its member companies the general adoption of 40 amp locked rotor as the permissible starting current for infrequently started 115-v single phase motors.

2—ACRMA recommended to its member companies the general adoption of 230 v for all equipment having more than 40 amp locked rotor at 115 v.

Assuming full effect and cooperation of the membership of these industry associations, the room air conditioners on the future secondary should consist of both 115 v and 230 v motors and the capacity of the secondary should be adequate to take care of the 40 amp locked rotor currents of manually controlled 115 v appliance. Under these conditions, adequate electric service can be rendered to users for all normal saturations that may be encountered for a long time to come.

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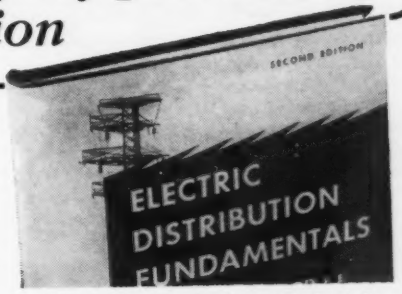

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